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NATIONAL RECOVERY PLAN FOR THE WHOOPING CRANE

Recovery of Nationally Endangered Wildlife

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NATIONAL RECOVERY PLAN FOR THE WHOOPING CRANE

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For
The Recovery of Nationally Endangered Wildlife Committee

Approved:
Date: June 1993

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Disclaimer

This is a review draft of the National Recovery Plan for the Whooping Crane. It has been prepared by members of the Canadian Whooping Crane Recovery Team to define recovery actions that are deemed necessary to protect and recover the species. It does not necessarily represent official positions of the agencies or the views of the individuals involved in the plan's formulation. The goals, objectives, and recovery actions identified in the recovery document are subject to appropriations, priorities, and budgetary constraints of the participating jurisdictions and organizations, as well as to modifications resulting from changed objectives or new findings. Therefore, some aspects of this plan may not necessarily be implemented immediately, concurrently, or in their entirety.

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Recovery plan summary

Whooping Cranes *Grus americana* are protected in Canada under the *Migratory Birds Convention Act*, the *National Parks Act*, and provincial/territorial wildlife legislation. The Canadian Wildlife Service (CWS) has taken the lead in Canada in developing and implementing programs designed to preserve and enhance the migratory Whooping Crane population that breeds in and near Wood Buffalo National Park (WBNP) and winters in coastal Texas on or near the Aransas National Wildlife Refuge (ANWR). A number of agencies share responsibilities for conservation of Whooping Cranes in Canada, including CWS, the Canadian Parks Service (CPS), the provinces of Alberta, Saskatchewan, and Manitoba, and the Northwest Territories, all of which work cooperatively to implement this recovery plan.

In April 1990, CWS and the United States Fish and Wildlife Service (USFWS) renewed the 1985 Memorandum of Understanding on the Conservation of the Whooping Crane (hereafter referred to as the Canada–U.S. MOU; Appendix 1) to enhance cooperation and coordination between our two nations and as a basis for development of national Whooping Crane recovery plans. The U.S. Whooping Crane Recovery Plan was approved in January 1980 and revised in December 1986, and it contains details of the breeding biology and history of Whooping Cranes both in the Wood Buffalo–Aransas (WB–A) population and in the Grays Lake experimental flock. The U.S. plan is currently undergoing a second revision.

In 1988, Canada adopted the Canadian Whooping Crane Recovery Plan (Cooch 1988), which established objectives for the recovery of the species and included a contingency plan in the event of an accident and the Canada–U.S. MOU. The Canadian and U.S. recovery plans are closely integrated, and each plan represents a course of action to be carried out within each country.

Since the original Canadian plan was written, substantial changes have occurred in Whooping Crane management, both in Canada and in the United States:

- Transfer of Whooping Crane eggs to Grays Lake was terminated in 1989, primarily because the established Whooping Crane population had suffered high mortality and had failed to reproduce. Reproductive failure was believed to have been caused by young Whooping Cranes becoming inappropriately imprinted on their Sandhill Crane *Grus canadensis* foster parents, leading to an inability to select mates from their own species. Although cross-fostering would appear to be an unsuitable technique for reintroduction, further experimentation might demonstrate the utility of using male Whooping Cranes returning to Grays Lake as guide birds for adopted Whooping Crane chicks not inappropriately imprinted.

- Some progress has been made in the development of techniques other than cross-fostering, such as puppet rearing of Whooping Crane chicks in the presence of adult Whooping Cranes, which corrects imprinting problems.

- A second captive flock of Whooping Cranes has been established at the International Crane Foundation, Baraboo, Wisconsin, initially with birds taken from the existing captive flock at Patuxent Wildlife Research Center, and later supplemented with eggs from WBNP.

- The Calgary Zoo has been approved as the site for Canada's first captive flock, with the first two pairs of Whooping Cranes arriving there in November and December 1992. This site was selected after Canadian zoological institutions were asked to express an interest in raising Whooping Cranes in captivity.

- A program to establish a nonmigratory flock of Whooping Cranes in Florida

has been approved, with the first release of 14 captive-raised Whooping Cranes taking place in January 1993.

- There is now a requirement to prepare recovery plans for all endangered and threatened species on the Canadian Endangered Species List, which is prepared annually by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC). These recovery plans must conform to a common format and are approved by the committee for the Recovery of Nationally Endangered Wildlife (RENEW). The currently approved Whooping Crane Recovery Plan does not fit the required format.

Because of these and other factors, Canada has revised its recovery plan, in keeping with the RENEW guidelines.

In 1941, the wild migratory population of Whooping Cranes had dropped to 16 birds, and a remnant nonmigratory flock in Louisiana had dropped to only six birds. By 1966, when the present program began, the wild population had increased to 43 birds, but the Louisiana flock had ceased to exist. The population breeding in Canada reached 146 birds in the winter of 1990–91, although there was a decline to 131 birds in the following year. A record 40 pairs nested in the WBNP area in 1992. By the year 2000, over 200 individuals of North America's tallest and most spectacular bird are expected to be present in the wild flock. It is expected that with persistent conservation efforts, the wild population will continue to increase for the foreseeable future.

This recovery plan outlines a course of cooperative action to be carried out in Canada, which will protect and increase Whooping Crane populations in Canada and elsewhere, and which will result in an eventual downlisting of the species from its present endangered status. To accomplish this goal, the primary objectives of the plan are:

(1) to establish a stable or increasing WB–A population with a minimum of 40 breeding pairs by the year 2000, and
(2) to establish and support two other wild Whooping Crane populations, each with a minimum of 25 breeding pairs, by the year 2020.

These objectives should be met for 10 consecutive years before downlisting of the species will be considered.

This new plan contains the following strategies for the recovery of the species:

(1) Protect Whooping Cranes and their habitat in and near WBNP, and maximize the productivity of the WBNP population.
(2) Protect Whooping Cranes and their habitat at areas other than WBNP, including the migration corridor and stopover and staging areas.
(3) Establish additional wild populations as per the Canada–U.S. MOU.
(4) Establish a captive breeding population in Canada.
(5) Continue a comprehensive public relations program to increase awareness and support for the goals and objectives as stated in this recovery plan.

Section 1. Introduction/species' background/status evaluation

1.1 Introduction

Of the 15 species of cranes in the world, only the Whooping Crane *Grus americana* and the Sandhill Crane *Grus canadensis* are endemic to North America. The Whooping Crane is the tallest North American bird, with males approaching 1.5 m in height. Snowy white, with black wing tips and a red crown, the long-lived Whooping Crane is a striking and majestic bird. The species was classified as endangered after being reduced from an estimated 1300–1400 birds in 1870 (Allen 1952) to only 21 birds in two populations in 1944. The single remaining wild population now numbers about 140 birds (adults and juveniles), with 40 pairs nesting in the Wood Buffalo National Park (WBNP) area in 1992. The flock winters on the Gulf of Mexico, in and near the Aransas National Wildlife Refuge (ANWR), Texas.

Spring migration from ANWR begins in late March or early April, and all birds have usually left the refuge by the end of April. Breeding birds return to that part of the breeding range in the WBNP area where they have nested before. Several pairs of Whooping Cranes have nested in the same areas for 19 consecutive years.

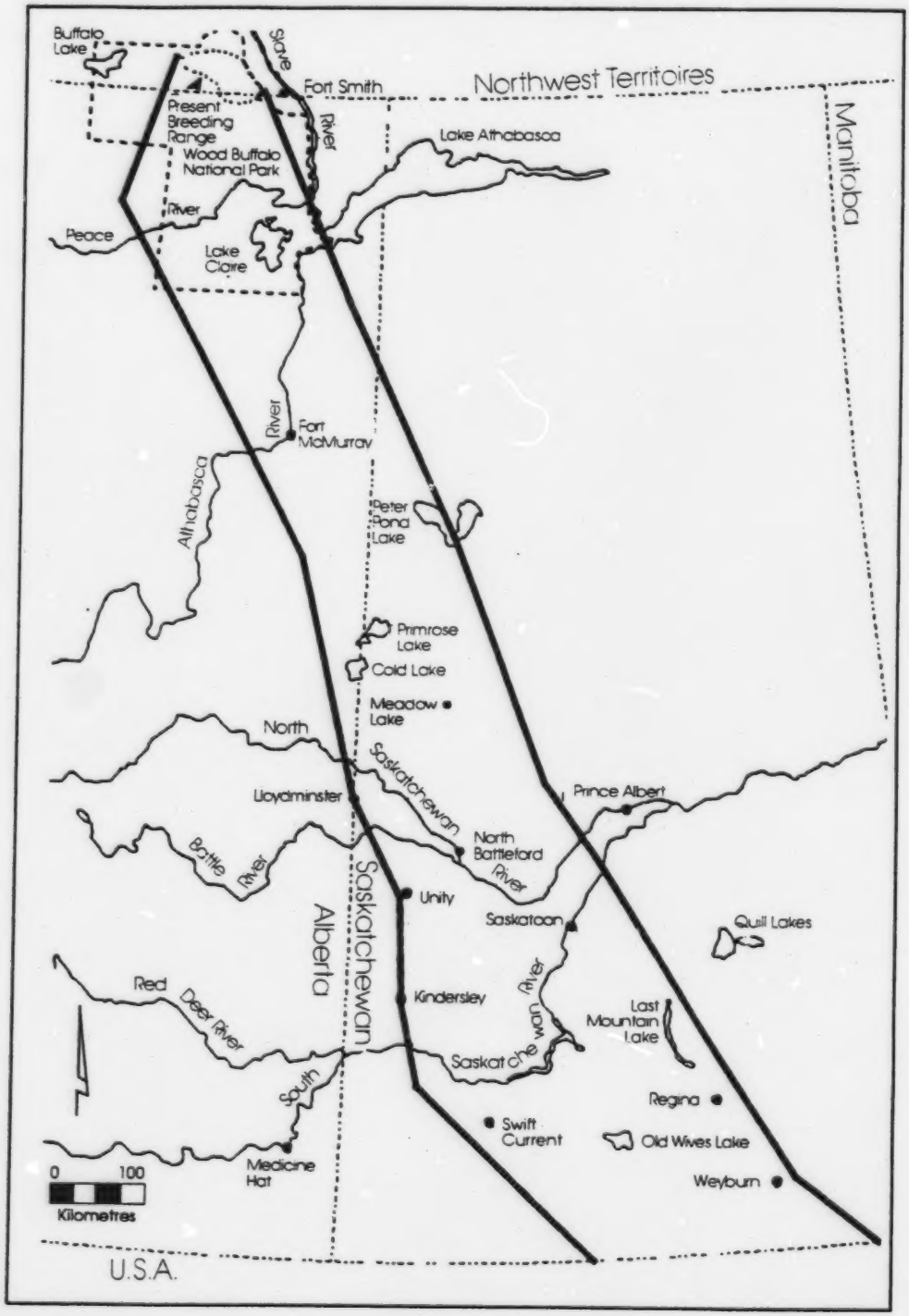
The nesting area used by a pair over a number of years may be as large as 47 km^2 but averages about 4.1 km^2 (Kuyt 1981a; Kuyt 1993a). Adjoining Whooping Crane pairs usually nest at least 1 km apart (Kuyt 1981a). Nests are built in marshes and are composed of bulrush, sedge, and, rarely, cattail. Eggs are predominantly light brown or buffy olive in colour and have dark brown and purplish blotches, particularly on the large end of the egg. Clutch size is usually two eggs, occasionally one egg, and rarely three eggs.

In the wild, incubation is 29–30 days (Kuyt 1982), and both adults share incubation duties. Egg predation is rare, and renesting by Whooping Cranes has been documented only a few times (Kuyt 1981b). Some chicks disappear each year, and wolf predation has been occasionally documented (Kuyt et al. 1981). Little is known about the summer food habits of Whooping Cranes, but feeding areas (margins of shallow ponds and marshes) reflect likely food items. Larval forms of insects, snails, leeches, frogs, and minnows are probably taken in these areas, as well as small rodents and berries in drier areas.

Chicks are capable of swimming shortly after hatching, and family groups leave the nest site a day or so later. Juveniles are capable of flight at about 80–90 days but are rarely seen flying before onset of migration. Sexually immature birds (up to four-year-olds) spend the summer as pairs or in small "bachelor" groups of three to five birds, rarely as singles. These birds usually occur on the peripheries of territories of breeding pairs within the same summer range.

Whooping Cranes migrate south as pairs, in family groups, or as small flocks of three to five birds, beginning about mid-September. Family groups are amongst the last birds to leave the breeding range. Their first stop often occurs in northeast Alberta or northwest Saskatchewan, about 500 km southeast of their departure area in WBNP. The migration corridor (Fig. 1) was determined by radio-tracking Whooping Cranes during the period 1981–1984 (Kuyt 1992). Local weather conditions influence distance and direction of travel, but Whooping Cranes generally are capable of reaching the north-central portion of the Saskatchewan agricultural area on the second day of migration. Most of the cranes remain for two to four weeks in the large triangle between Regina, Swift Current, and Meadow Lake, where they feed on waste grain in barley and wheat stubble fields and roost in the many wetlands. The rest of the migration from Saskatchewan to the wintering grounds is usually rapid, probably weather-induced, and may be completed in a week (Kuyt 1992).

Figure 1. **Whooping Crane migration corridor in Canada, 1981–1984**



1.2 Evaluation of Whooping Crane current status

1.2.1 Factors influencing Whooping Crane vulnerability and contributing to its endangered status

1.2.1.1 Biological considerations

1.2.1.1.1 Status of populations

Loss of marshland habitat, shooting, and egg collecting contributed to a severe decline in numbers of Whooping Cranes, extending from the latter part of the 19th century into the 1930s. By 1941, the migratory population, annually summering in unknown areas at that time and wintering on ANWR, was reduced to 15 or 16 birds, including perhaps four or five breeding pairs. In 1954, when the cranes' nesting area was discovered in WBNP, the population had increased to 21 birds.

In 1966, when CWS and the USFWS increased management efforts in response to growing public concern, the migratory population numbered 44 birds. Five birds, including an injured bird captured in WBNP as a juvenile in 1964, existed in captivity.

Although Whooping Cranes usually lay clutches of two eggs, only about 10% of families arriving on the winter range have two chicks (Erickson 1975). About 90% of nests therefore contain one egg, which is unlikely to result in a fledged chick. Erickson (1975) suggested that the number of cranes could be increased by removing one egg from a clutch and rearing it elsewhere. The second eggs are collectively termed "surplus," and the collection and transfer of these surplus eggs from WBNP to the Patuxent Wildlife Research Center in Maryland began in 1967, when six eggs were shipped (Table 1). Subsequent egg transfers to Patuxent, and later to the International Crane Foundation, Baraboo, Wisconsin, starting in 1990, helped to build the captive flocks to a population of 70 birds by spring 1992. Viability testing of eggs during collection was initiated in 1985, with the objective of leaving at least one viable egg in each nest. As a result of this procedure, the hatching success of tested known live eggs left in nests increased by 11.7–15.5% during the period 1985–1988 (Kuyt 1993b).

A serious, unexplained loss of 13 (mostly nonbreeding) birds between fall 1971 and fall 1972, in combination with below-average survival of juveniles in 1973 and 1974, resulted in a population of 49 birds in 1974, only one more than the 48 birds present in 1967. From spring 1975 to spring 1977, the population jumped from 49 to 69 birds. During the next seven years, (1977–1983), the population increased by only six birds to 75. However, from 1983 to 1989, the population went from 75 to peak at 146 birds (Table 1). Dry habitat conditions on the breeding range in 1990 and 1991 depressed production, and, with unexplained losses at ANWR of more than a dozen birds during that period, the population declined to 131 birds in early 1992.

The present population (1992) contains a large contingent of nonbreeding birds (Table 1) consisting of juveniles, two- and three-year-olds, and cranes capable of breeding but not doing so because of unfavourable habitat conditions, recent loss of mates, old age, or a combination of these factors. This reservoir of nonbreeders should compensate for losses of breeding birds, and, indeed, the much improved habitat conditions of 1992 resulted in a record 40 nesting pairs.

Canadian support to establish a second wild Whooping Crane population began in 1975, when 14 surplus eggs were shipped from WBNP to the Grays Lake National Wildlife Refuge in Idaho (Table 1). Single Whooping Crane eggs were exchanged for Greater Sandhill Crane *Grus canadensis tabida* eggs (Drewien and Bizeau 1978). The Sandhill Cranes

Table 1. Composition of Wood Buffalo–Aransas Whooping Crane population, and disposition of surplus eggs, 1966–1991

Year	Total population[1]	No. of known breeding pairs	No. of juveniles[1]	Max. no. of nonbreeders (including juveniles)[1]	Destination of eggs removed from WBNP		
					Patuxent[2]	Grays Lake	ICF[3]
1966	43	5[4]	5	–[5]	–	–	–
1967	48	9[4]	9	–[5]	6	–	–
1968	50	10	6	30	10	–	–
1969	56	12	8	32	10	–	–
1970	57	15	6	27	–	–	–
1971	59	13	5	33	11	–	–
1972	51	16	5	19	–	–	–
1973	49	14	2	21	–	–	–
1974	49	15	2	19	13	–	–
1975	57	16	8	25	–	14 (3)	–
1976	69	16	12	37	–	15	–
1977	72	17	10	38	–	16	–
1978	75	15	7	45	–	13 (2)	–
1979	76	19	6	38	–	19 (3)	–
1980	78	19	6	40	–	12 (2)	–
1981	73	17	2	39	–	12 (2)	–
1982	73	17	6	39	2	14 (1)	–
1983	75	24	7	27	2	16	–
1984	86	29	15	28	3 (2)	22	–
1985	97	28	16	41	4 (3)	23 (3)	–
1986	110	29	21	52	10 (6)	15 (2)	–
1987	134	32	25	70	12 (5)	12	–
1988	138	31	19	76	14[6](6)	12	–
1989	146	31	20	84	15 (8)	–	–
1990	146	32	13	82	–	–	12 (1)
1991	132	33	8	66	16 (5)	–	–
1992	136	40	15	56	10 (1)	–	11 (1)
Total					**138 (36)**	**215 (18)**	**23 (2)**

[1] Fall arrivals, ANWR and area (U.S. Fish & Wildlife Service 1986; Refuge Manager, ANWR, pers. commun.).

[2] Patuxent Wildlife Research Center, Maryland.

[3] International Crane Foundation, Baraboo, Wisconsin.

[4] Data incomplete.

[5] Cannot be calculated, as data on number of known breeding pairs are incomplete.

[6] Excluding one Sandhill Crane egg.

( ) Included in totals are nonviable eggs or eggs failed as a result of embryonic death (1975–1988 data from R.C. Drewien).

accepted the Whooping Crane eggs, and the resultant chicks learned their foster parents' migration pathway to the vicinity of the Bosque del Apache National Wildlife Refuge in New Mexico. The hope that the foster parent scheme would result in a self-perpetuating, free-flying Whooping Crane population annually migrating between Idaho and New Mexico was not realized. High mortality, due in part to adverse weather, predation, accidents, and disease, an unequal sex ratio (scarcity of females apparently due to their higher mortality), and wide dispersal of females on summering areas were limiting factors. Pair bonding, which would normally precede pairing and natural breeding, has not been observed in the Grays Lake flock. The lack of pairing may be due to improper imprinting or to inappropriate behaviour learned from foster parent Sandhill Cranes.

At the 1989 meeting of the U.S. Whooping Crane Recovery Team, the team recommended that the annual transfer of surplus Whooping Crane eggs from WBNP to Grays Lake be discontinued. Research continued at Grays Lake until 1992, but cross-fostered females appeared incapable of normal breeding behaviour.

CWS transferred a total of 215 Whooping Crane eggs from WBNP to the Grays Lake project between 1975 and 1988. An additional 73 eggs were transported to Grays Lake from the captive flock at the Patuxent Wildlife Research Center. The new migratory population, sometimes referred to as the Rocky Mountain Whooping Crane population, reached a total of 32 birds in winter 1984–85; in the absence of reproduction, however, the population has steadily declined, with nine birds remaining in 1993. Although no breeding pairs have formed, much information has been acquired that will be invaluable when attempts are made to establish other flocks. Two or three male birds that do not winter on public lands will be captured and added to the Calgary captive flock, and other birds may be used in the lead bird study to determine if they can successfully adopt Whooping Crane chicks and teach them migration. If successful, this procedure would overcome the imprinting problems that have prevented Whooping Cranes from breeding at Grays Lake.

1.2.1.1.2 Current and past distribution

Although the historical range of the Whooping Crane is believed to have extended from the Arctic coast to Central Mexico and from Utah to the Atlantic seaboard, the major nesting area during the 19th and 20th centuries extended from central Illinois, northwestern Iowa, northwestern Minnesota, and northeastern North Dakota in a northwesterly direction through southwestern Manitoba and southern Saskatchewan and into east-central Alberta (Allen 1952). Although Allen reported historical nests near the north end of WBNP, he was unaware of the nearby nesting area, which was not discovered until 1954. A separate small, and apparently nonmigratory, flock existed as a breeding population in southwestern Louisiana until 1939. This population became extinct in 1948, when the last survivor was taken into captivity.

1.2.1.1.3 Incidence of disease or pests

Captive Whooping Cranes are susceptible to a variety of diseases, yet there has been no known outbreak in the wild population. From 1976 to 1989, the USFWS necropsied or examined 25 Whooping Crane carcasses found dead in the field or removed from the wild because of

sickness or debility. Avian tuberculosis was diagnosed in seven (from both populations) of the carcasses examined, and chronic avian cholera was diagnosed in one individual from the Grays Lake population (Brand et al. 1992). One Whooping Crane is known to have died of acute lead poisoning.

The captive Whooping Crane flock at the Patuxent Wildlife Research Center has been particularly susceptible to disease; in 1984, seven cranes died there from eastern equine encephalitis, a previously unknown disease of this species. This is a concern for the proposed Florida release of Whooping Cranes. More than five captive cranes at Patuxent have died from disseminated visceral coccidiosis, and an additional three have succumbed to mycotoxicosis caused by toxins in food.

1.2.1.1.4 Commercial or subsistence use

Whooping Cranes are not currently exploited commercially or used for subsistence purposes.

Hunting of look-alike species, such as Snow Geese *Anser caerulescens* and Sandhill Cranes, in the migration corridor of Whooping Cranes poses a significant threat. At least four Whooping Cranes are known to have been shot between 1989 and 1991, either on migration or near ANWR.

1.2.1.2 Habitat considerations

1.2.1.2.1 Overview of habitat requirements

Whooping Cranes formerly bred in isolated marshes on the prairies and in aspen parkland. The current nesting grounds have been described as a marshy area interspersed with numerous potholes that are separated by land areas with black spruce *Picea mariana*, tamarack *Larix laricina*, and willows (mostly *Salix candida*). The understory is dwarf birch *Betula glandulosa* and several species of lichen, underlain by sphagnum moss (Novakowski 1966).

The original winter range was confined chiefly to a coastal strip extending from northern Mexico along the Texas coast to Louisiana (Allen 1952), but present winter usage is restricted to ANWR and adjacent coastal wetlands. Cranes set up winter territories in the brackish coastal wetlands where they feed on blue crabs *Callinectes sapidus*, shrimp, clams, and other aquatic organisms (Allen 1952). Wolfberries *Lycium carolinianum* on tidal flats and acorns on uplands also form part of the diet (Allen 1952).

1.2.1.2.2 Status of critical habitat

The present breeding range is quite restricted, although apparently suitable similar range exists in other areas of WBNP and vicinity. Wetlands suitable for breeding may also still exist in the historical range on the prairies, although dry conditions in recent years and agricultural practices have greatly decreased the number and extent of these wetlands. There are a number of traditional stopover areas in Saskatchewan that are important to migrating cranes.

The distribution, quantity, and security of habitat on the winter range are probably more limiting for continued growth of the species than the conditions on the breeding ground.

1.2.1.2.3 Existing and future land use conflicts

The present breeding range in WBNP is secure from competing land use activities. Expansion of the flock out of the park into adjacent areas of Alberta and the Northwest Territories would be into habitat with no formal protection. Land uses such as forestry, hunting, and cattle grazing could cause disturbance or change the quality of habitat available for cranes. Known staging areas and potential breeding wetlands on the prairies could be negatively impacted by drought or by drainage, cattle grazing,

contaminated runoff, or other disturbances associated with agricultural activities.

On the wintering grounds, the Gulf Intracoastal Waterway (GIW), which cuts through the coastal marshes, requires periodic channel dredging to maintain depth for the continuous stream of barge and other traffic. Disposal of dredged materials on adjacent crane habitat may result in contamination. On the uplands, urban development and agriculture cause loss of habitat outside the refuge.

1.2.1.2.4 Effects of human activities
Pollution: A major concern exists with the continued presence of barges carrying petrochemical and other toxic products in the GIW. Collisions or grounding of barges could result in an oil or chemical spill, which could make much of the refuge uninhabitable for cranes. Whooping Cranes on the winter range are also exposed to contaminants associated with runoff from agricultural and industrial activities and subjected to risks associated with offshore and onshore gas and oil operations. Nearby Lavaca Bay has been closed for some years to the harvesting of fish and crabs because of industrial pollution (Lewis et al. 1992). In addition, marine traffic continues to cause erosion of the refuge shoreline and breaching of the brackish ponds where the Whooping Cranes feed. If not kept in check, this erosion could lead to loss of the critical winter habitat for the present wild flock.

Urban/rural development: Collisions with man-made objects have caused considerable mortality in the Grays Lake flock. At least 11 birds from this flock have died or have been seriously injured as a result of power line strikes, and at least another five have hit fences. Within the WB–A flock, at least five birds are believed to have suffered collisions with power lines, with two of the nine radio-tagged birds striking power lines within 18 months after being tagged. Low fences around wetland roosting or feeding sites may also pose a hazard to crane movements, particularly at times of low visibility.

1.2.2 The role of the Whooping Crane in ecosystems, and interactions with humans

1.2.2.1 Ecological considerations

1.2.2.1.1 Ecological role
Breeding Whooping Cranes spend their summers and winters in restricted locations and may therefore exert a pressure on invertebrate food species, which may cause local depletions. However, the total Whooping Crane population is so small that it is unlikely to exert any ecological effects except in small areas. Whooping Cranes are not regular prey for other species, although eggs or young birds may occasionally be taken by predators.

1.2.2.1.2 Taxonomic position
The Whooping Crane belongs to the family Gruidae, part of the order Gruiformes, which contains 15 crane species worldwide. The genus Grus contains nine species and is the genus to which the two native North American cranes, the Whooping Crane and the Sandhill Crane, belong. The Whooping Crane has no subspecies.

1.2.2.2 Sociopolitical considerations

1.2.2.2.1 Public appeal/existence value
The Whooping Crane is the flagship species of the North American wildlife conservation movement and symbolizes the struggle for survival that characterizes many endangered species worldwide. It is a large, distinctive, and photogenic bird, popular with the public and the media, and it is often used to illustrate endangered species literature.

Several nongovernment wildlife organizations have assisted in the recovery of the Whooping Crane, and

one of these, the Whooping Crane Conservation Association, which was formed in 1961, regularly dispenses information about the species. Corporate sponsors have also assisted in funding the Whooping Crane project.

1.2.2.2.2 Utilitarian value
Although the Whooping Crane has no intrinsic utilitarian value that can be realized today, it is a major draw for visitors to WBNP and the Northwest Territories and a valuable subject for photographers, artists, and wildlife watchers who annually contribute millions of dollars to the Gulf coast economy. Conservation of habitat for Whooping Cranes has the added advantage that the habitat can be used by many other species.

1.2.2.2.3 Legal considerations
The Whooping Crane is protected in Canada by the *Migratory Birds Convention Act*, the *National Parks Act*, and provincial and Northwest Territories wildlife acts.

1.2.2.2.4 Proportion of breeding population in Canada
Wild Whooping Cranes breed only in Canada. During the 1992 nesting season, a record 40 nests were found in the WBNP area. The wild flock summering in this area includes breeding adults, nonbreeders, subadults, and juveniles, and it numbers about 140 individuals.

1.2.3 Recovery potential of the Whooping Crane

1.2.3.1 Review of major causes of threat and likelihood of continued threat
A single catastrophic event could decimate the wild population. On the wintering grounds, the possibility of a major storm or a spill of toxic products from one of the barges that frequent the GIW is a continuing threat. In addition, the continued erosion of the banks of the GIW poses an ongoing threat to the habitat. Although the breeding range is secure because it is mostly in a national park, low water levels in some years may result in reduced productivity of Whooping Cranes. Disease, predation, collisions with power lines, and shooting will continue to take their toll of Whooping Cranes throughout their range.

Global climate change may adversely affect the water regime of the WBNP area, with potentially severe impacts on Whooping Crane reproduction. Permanently lowered water tables, for example, would shrink wetlands, reduce invertebrate food availability, and allow predators greater access to nests and young.

1.2.3.2 Current habitat/recovery protection efforts
The breeding range of the WB–A flock is secure from human-induced changes such as forestry or conversion to agricultural land, because it lies almost entirely within WBNP. To afford the highest level of protection, the breeding habitat is designated as a Zone I Special Preservation area. There are no man-made facilities, and human access is prohibited from April to September, except for park staff and scientists involved in Whooping Crane research.

Many of the prairie wetlands used regularly by migrating Whooping Cranes have received protection as Migratory Bird Sanctuaries, as National Wildlife Areas, or under the *Saskatchewan Wildlife Habitat Protection Act*.

1.2.3.3 Degree of habitat management required
As discussed above, breeding habitat is protected in WBNP. Under normal circumstances, habitat manipulation is not permitted in a national park. National park policy would allow for manipulation of natural processes only if feasible, beneficial, and urgent to achieve recovery goals.

1.2.3.4 Biological considerations affecting recovery

The Whooping Crane is a long-lived bird; it may live to be 30 years of age. Breeding does not begin until birds average 4.5 years of age (E. Kuyt, unpubl. data). As most crane nests contain two eggs, only one of which is likely to give rise to a fledged young, there is an opportunity for egg manipulation and removal of surplus eggs. This technique has been useful in increasing the hatching success of wild birds, in building captive flocks, and in establishing the wild Grays Lake flock.

Whooping Cranes follow learned migration pathways and nest and winter in traditional range. Thus, the pioneering potential for the species is low.

1.2.3.4.1 Recruitment rate

During the period 1989–1992, an average of 87% of the paired adults at least five years of age in the WB–A flock constructed a nest. Over the past 10 years, 76% of nests produced a hatchling, and about 69% of the hatchlings survived their first migration and reached ANWR (E. Kuyt, unpubl. data). Annual mortality after the first year is about 9% (Mirande et al. 1993), whereas the life span of a Whooping Crane in the wild is thought to range up to 30 years. A Population Viability Assessment (PVA) was conducted at a workshop in August 1991. Information presented at this workshop was used to estimate an annual growth rate of 4.6% for the WB–A flock (Mirande et al. 1992).

1.2.3.4.2 Minimum viable population

The present population of Whooping Cranes arose from the 18 individuals present in 1938. The results of 1000 runs of the PVA model simulating growth from 1938 to 1990 indicated that the population would become extinct in 3.6% of the simulations. When used to predict further growth of the WB–A flock, the PVA model indicated that the flock is large enough to sustain fairly steady, although not invariant, growth, and that it could reach a population of 500 birds by about the year 2018, provided that habitat conditions on both the breeding and wintering ranges are not limiting (Mirande et al. 1992). The present population therefore exceeds the size required for a minimum viable population.

The PVA model also predicted that a new nonmigratory wild population could be established in Florida with the release of 10 birds per year for 10 years. This would result in a viable, increasing population with a minimum of 25 breeding pairs (Mirande et al. 1992).

1.2.3.5 Competing species/predators

There is little competition by other species for nesting territories in WBNP. Few Sandhill Cranes nest there; those that do are easily driven off, as they are smaller than Whooping Cranes. The wintering grounds are also home to many thousands of other birds, including ducks, pelicans, egrets, herons, shorebirds, and gulls. There may be some competition from wading birds for food, because the Whooping Cranes, especially in early winter, feed on larger marine invertebrates in the coastal wetlands much of the time. In addition, competition for food from humans harvesting clams and crabs may be detrimental. The impact of this type of human activity is currently under study. Another study just being initiated will compare the nutritional content of wild foods and pelleted feeds provided to captive cranes.

Loss of young birds, and perhaps eggs too, in WBNP to predators is a concern. Within the park, wolves *Canis lupus*, black bears *Ursus americanus*, coyotes *Canis latrans*, hawks, eagles, and Common Ravens *Corvus corax* may opportunistically take eggs and young cranes, although only wolf predation of chicks and occasional bear predation of eggs have been documented. Adult birds appear less susceptible to predation unless they are weakened by disease, in which case they are extremely vulnerable.

Section 2. Recovery

The responsibility for the fate of the Whooping Crane rests with the citizens of Canada and the United States. The Canada–U.S. MOU provides a template for the Canadian and U.S. Whooping Crane recovery plans. These two closely linked plans outline the programs being carried out in the respective countries to secure the continued existence of the species. The Canadian recovery plan outlines a course of action that is to be carried out jointly by a number of agencies. The plan is designed to protect and increase Whooping Crane populations in Canada and elsewhere and result in an eventual recovery of the species from its present endangered status. Circumstances and opportunities will change over time, and the present document will require updating and revision if major changes in recovery efforts are contemplated.

2.1 Goal and primary objectives

The goal of this recovery plan is to increase populations of the Whooping Crane to the point where its status classification can be improved.

The primary objectives of this recovery plan are:

(1) to establish a stable or increasing WB–A population with a minimum of 40 breeding pairs by the year 2000, and

(2) to establish and support two other wild Whooping Crane populations, each with a minimum of 25 breeding pairs, by the year 2020.

These population objectives must be maintained for 10 consecutive years before the objectives can be considered to have been achieved. Further recovery efforts would still be required in future years to remove the species entirely from the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) list.

2.2 Strategies

(1) Protect Whooping Cranes and their habitat in and near WBNP, and maximize the productivity of the WBNP population.

(2) Protect Whooping Cranes and their habitat at areas other than WBNP, including the migration corridor and stopover and staging areas.

(3) Establish additional wild populations as per the Canada–U.S. MOU.

(4) Establish a captive breeding population in Canada.

(5) Expand the comprehensive public relations program to increase awareness and support for the goals and objectives as stated in this recovery plan.

2.3 Stepdown outline

2.3.1 Undertake background studies to fill information gaps pertinent to recovery efforts as identified by the ranking process.

2.3.1.1 Determine population status and distribution.

2.3.1.1.1 Update population and distribution data.

2.3.1.1.1.1 Undertake aerial surveys to locate breeding pairs and determine nesting success.

2.3.1.1.1.1.1 Determine distribution and number of nests, egg laying dates, and clutch size at each nest (CWS).

2.3.1.1.1.1.2 Document as fully as possible the history of each pair, and provide an annual update (CWS).

2.3.1.1.1.1.3 Assign permanent identification codes to each pair or territory to the degree possible (CWS).

2.3.1.1.2 Determine survival rates for Whooping Cranes in WBNP.

2.3.1.1.2.1 At regular intervals, conduct aerial surveys to determine survival and family movement (CWS).

2.3.1.1.2.2 Determine causes of egg loss and of chick and adult mortality (CWS).

2.3.1.1.2.3 Carry out a study to determine the survival of chicks in relation to food supply and fluctuations in water levels (CPS).

2.3.1.1.3 Examine migration, dispersal patterns, and associations.

2.3.1.1.3.1 Collect, collate, and publish information on Whooping Crane sightings, movement, and habitat used during migration (CWS).

2.3.1.1.3.2 Determine causes of mortality during migration (CWS).

2.3.1.1.3.3 Record association between Whooping Cranes, Sandhill Cranes, Snow Geese, and other waterfowl (CWS).

2.3.1.1.4 Determine population dynamics (productivity, recruitment).

2.3.1.1.4.1 Maintain records of productivity and survival of cranes (CWS).

2.3.1.1.4.2 Determine age of first breeding, longevity, and breeding history (CWS).

2.3.1.2 Define habitat requirements.

2.3.1.2.1 Locate and describe breeding and staging habitat.

2.3.1.2.1.1 Undertake aerial surveys in WBNP and vicinity to identify areas used by breeding cranes (CWS).

2.3.1.2.1.2 Survey and map movements of family groups on summer range (CWS).

2.3.1.2.1.3 Survey and map movement of failed breeders, subadult birds, and other nonbreeders in vicinity of nesting area, and identify areas used (CWS).

2.3.1.2.1.4 Survey adjacent habitat to locate new breeders (CWS).

2.3.1.2.1.5 Survey use of staging habitat (CWS).

2.3.1.2.2 Determine availability of suitable habitat for breeding, staging, migrating, and other essential uses.

2.3.1.2.2.1 Prepare annual maps to record distribution of nesting pairs, nests, and nonbreeders in WBNP and environs (CWS).

2.3.1.2.2.2 Survey and map potential breeding habitat at WBNP and vicinity using satellite imagery (CPS).

2.3.1.2.2.3 Integrate habitat mapping with historical nesting patterns using GIS to evaluate habitat utilization (CPS).

2.3.1.2.2.4 Prepare maps of migration and staging habitat (CWS).

2.3.1.2.3 Determine characteristics of inhabited and unoccupied habitat.

2.3.1.2.3.1 Sample potential food resources of nearby areas where cranes do not occur (CPS).

2.3.1.2.3.2 Sample potential food resources of crane feeding areas within territories (CPS).

2.3.1.2.3.3 Conduct a comparative study on distribution and

characteristics of ponds in currently used and potential breeding areas (CPS).

2.3.1.2.4 Determine factors affecting habitat quality.

2.3.1.2.4.1 Assess impact of water level fluctuation on food availability and relate those levels to Whooping Crane reproductive success (CPS).

2.3.1.2.4.2 Expand existing surface water monitoring network to determine water level fluctuations in crane habitat (CPS).

2.3.1.2.4.3 Determine the role of fire in creating and maintaining Whooping Crane habitat (CPS).

2.3.2 Analyze data to estimate population size, habitat, and recruitment required to achieve goal.

2.3.2.1 Identify key habitat areas required to attain recovery goal.

2.3.2.1.1 Map location of key breeding areas in and near WBNP.

2.3.2.1.1.1 Prepare maps of key existing breeding habitat in and near WBNP (CPS).

2.3.2.1.2 Map location of staging habitat in Saskatchewan.

2.3.2.1.2.1 Prepare maps of key staging habitat in Saskatchewan (CWS).

2.3.2.1.3 Map locations of potential reintroduction sites in Saskatchewan, Manitoba, and western Ontario.

2.3.2.1.3.1 Prepare maps of potential reintroduction sites in Saskatchewan, Manitoba, and western Ontario (CWS).

2.3.2.2 Evaluate ability of existing and potential habitat to support increased population.

2.3.2.2.1 Map locations of potential breeding habitat in and near WBNP, and determine carrying capacity.

2.3.2.2.1.1 Prepare maps of potential breeding habitat in and near WBNP, and assess carrying capacity (CPS).

2.3.2.2.1.2 Compile, analyze, and interpret the results of surface water monitoring (CPS).

2.3.2.2.2 Determine size of area used by individual pairs and progeny to assist in assessing carrying capacity of the habitat.

2.3.2.2.2.1 Prepare maps of territories used by individual pairs of cranes (CWS).

2.3.2.3 Estimate population needed to sustain breeding population at recovery goal level.

2.3.2.3.1 Periodically update the Population Viability Assessment model.

2.3.2.3.1.1 Update the Population Viability Assessment model with incorporation of new methodologies used to estimate minimum viable population size and genetic integrity of the species (CWS).

2.3.2.3.1.2 Develop management options by comparing mean annual growth rates for WBNP population with and without current egg manipulation practices (CWS).

2.3.2.4 Determine long-range consequences of human encroachment.

2.3.2.4.1 Determine impact on current habitat use.

2.3.2.4.1.1 Assess impact of outside threats to habitat use within WBNP (CPS).

2.3.3 Implement required actions to ensure goal is reached.

2.3.3.1 Ecological actions.

2.3.3.1.1 Protect and enhance crane habitat.

2.3.3.1.1.1 Protect breeding grounds from human disturbance.

2.3.3.1.1.1.1 Identify and protect essential breeding habitat and food base (CPS).

2.3.3.1.1.1.2 Continue to restrict aircraft flights over the crane breeding area (CPS).

2.3.3.1.1.1.3 Implement measures to prevent potentially harmful resource or recreational expansion into the breeding area (CPS).

2.3.3.1.1.2 Protect staging habitat from disturbance.

2.3.3.1.1.2.1 Manage potential disturbance to staging cranes by tourists or other visitors (CWS).

2.3.3.1.1.2.2 Consult with landowners to develop a program to ensure security of cranes using migration or staging habitats (CWS).

2.3.3.1.1.2.3 Develop and apply methods to prevent collisions with power lines, communication towers, or other structures (CWS).

2.3.3.1.1.2.4 Identify, evaluate, and reduce other hazards along migration route (CWS).

2.3.3.1.2 Reduce crane mortality on breeding grounds and during migration.

2.3.3.1.2.1 Monitor Whooping Crane health on the breeding grounds and during migration (CWS).

2.3.3.1.2.2 Determine location of staging areas or migration habitat, and assess risks to cranes using those areas (CWS).

2.3.3.1.2.3 Continue to identify, evaluate, and minimize other mortality factors (CWS).

2.3.3.1.3 Develop contingency plans for major disruptions.

2.3.3.1.3.1 Maintain and update contingency plan (Appendix 2) (CWS).

2.3.3.2 Intensive management techniques.

2.3.3.2.1 Establish and maintain Whooping Crane breeding facilities.

2.3.3.2.1.1 Monitor progress and provide continued support by participation in joint Canada–U.S. Whooping Crane breeding projects.

2.3.3.2.1.1.1 Contribute eggs from WBNP to existing breeding facilities (CWS).

2.3.3.2.1.1.2 Undertake an analysis of eggs that failed to hatch (CWS).

2.3.3.2.1.2 Construct and operate a captive breeding centre in Canada.

2.3.3.2.1.2.1 Complete construction of a Whooping Crane captive breeding facility at the Calgary Zoo (CZ).

2.3.3.2.1.2.2 Stock the facility with Whooping Cranes and Sandhill Cranes (CZ).

2.3.3.2.1.2.3 Operate the facility to produce Whooping Crane eggs and chicks for release in Canada (CZ).

2.3.3.2.1.2.4 Develop a management plan complete with genetic and demographic objectives for the Canadian captive flock (CZ).

2.3.3.2.2 Establish additional wild populations.

2.3.3.2.2.1 Establish one independent wild breeding population with a minimum of 25 breeding pairs of Whooping Cranes in Canada, separate from the WBNP population, by 2020.

2.3.3.2.2.1.1 Evaluate potential reintroduction sites in suitable habitat in Saskatchewan, Manitoba, or western Ontario (CWS).

2.3.3.2.2.1.2 Conduct preliminary field studies to determine migration, staging, and wintering range for resident Sandhill Cranes (CWS).

2.3.3.2.2.1.3 Survey potential breeding areas to determine location, extent, and quality of habitat (CWS).

2.3.3.2.2.1.4 Survey staging habitat to determine location, extent, and quality of habitat (CWS).

2.3.3.2.2.1.5 Survey wintering areas to determine suitability for development of Whooping Crane pair territories (CWS).

2.3.3.2.2.1.6 Develop a long-term funding source for the project (CWS).

2.3.3.2.2.1.7 Conduct releases, monitor results, and manage released population (CWS).

2.3.3.2.2.2 Provide support and assistance with the establishment of wild flocks in the United States (CWS).

2.3.3.2.3 Enhance productivity of the WBNP flock.

2.3.3.2.3.1 Maximize productivity of WBNP flock through testing and substitution of eggs and collection of surplus eggs.

2.3.3.2.3.1.1 Test viability of eggs at nests and ensure that at least one live egg is left in each nest (CWS).

2.3.3.2.3.1.2 Collect surplus live eggs and nonviable eggs (CWS).

2.3.3.3 Sociopolitical actions.

2.3.3.3.1 Develop public support for conservation activities.

2.3.3.3.1.1 Issue press releases on a regular basis to announce significant events (CWS).

2.3.3.3.1.2 Maintain a program to report Whooping Cranes during spring and autumn passage through the Prairie provinces (CWS).

2.3.3.3.1.3 Prepare and distribute annual and interim reports of activities carried out under this program (CWS).

2.3.3.3.1.4 Use interpretive programs and media contacts to support Whooping Crane conservation (CWS).

2.3.3.3.2 Develop enforcement programs to protect populations.

2.3.3.3.2.1 Conduct hunter education programs in the migration pathway (CWS).

2.3.3.3.2.2 Monitor hunting activity during Whooping Crane migration (CWS).

2.3.3.3.2.3 Investigate suspected cases of loss to shooting, and proceed with charges if warranted (CWS).

2.4 Narrative

2.4.1 Undertake background studies to fill information gaps pertinent to recovery efforts as identified by the ranking process.

2.4.1.1 Determine population status and distribution.

2.4.1.1.1 Update population and distribution data.

2.4.1.1.1.1 Undertake aerial surveys to locate breeding pairs and determine nesting success.
These activities have been ongoing for many years and have provided a great deal of information about nesting activities of the cranes. They will need to be continued until such time as no further egg manipulations are required.

2.4.1.1.1.1.1 Determine distribution and number of nests, egg laying dates, and clutch size at each nest (CWS).

2.4.1.1.1.1.2 Document as fully as possible the history of each pair, and provide an annual update (CWS).
The colour-banding program was discontinued when the objectives of the program had been met. However, the remaining colour-banded birds can still provide useful information such as that indicated in this action. There is no intention of resuming the colour-banding program.

2.4.1.1.1.3 Assign permanent identification codes to each pair or territory to the degree possible (CWS).

2.4.1.1.2 Determine survival rates for Whooping Cranes in WBNP.
Mortality of adults is relatively low on the breeding grounds. A more serious concern is the loss of a large proportion of the annual production of chicks. Causes of death are not known but could include predation, disease, malnutrition, starvation due to drought, or poor parenting behaviour. Potential disease outbreaks in or near WBNP will be identified if possible.

2.4.1.1.2.1 At regular intervals, conduct aerial surveys to determine survival and family movement (CWS).
Annual surveys are conducted in June with the assistance of USFWS aircraft. Follow-up surveys are conducted by CWS through August.

2.4.1.1.2.2 Determine causes of egg loss and of chick and adult mortality (CWS).
Potential diseases in WBNP Whooping Cranes will be identified (if possible) and action taken according to the contingency plan (Appendix 2).

2.4.1.1.2.3 Carry out a study to determine the survival of chicks in relation to food supply and fluctuations in water levels (CPS).

2.4.1.1.3 Examine migration, dispersal patterns, and associations.

2.4.1.1.3.1 Collect, collate, and publish information on Whooping Crane sightings, movement, and habitat used during migration (CWS).

2.4.1.1.3.2 Determine causes of mortality during migration (CWS).
There are a variety of known mortality factors that include, among others, predation, disease, hunting, and power line collisions. Recent losses of almost 20 Whooping Cranes in the WB–A population emphasize the ever-present vulnerability of this species. Identifying causative factors for such losses and developing mitigating measures are, and have been, an important part of Whooping Crane management. Veterinary staff capable of determining cause of mortality of recovered cranes are listed in the contingency plan.

2.4.1.1.3.3 Record association between Whooping Cranes, Sandhill Cranes, Snow Geese, and other waterfowl (CWS).
Sandhill Cranes and Snow Geese are the primary "look-alike" species that can cause confusion during hunting season. Mass gatherings of waterfowl can increase the possibility of disease outbreaks at some sites.

2.4.1.1.4 Determine population dynamics (productivity, recruitment).

2.4.1.1.4.1 Maintain records of productivity and survival of cranes (CWS).

2.4.1.1.4.2 Determine age of first breeding, longevity, and breeding history (CWS).

2.4.1.2 Define habitat requirements.

2.4.1.2.1 Locate and describe breeding and staging habitat.

2.4.1.2.1.1 Undertake aerial surveys in WBNP and vicinity to identify areas used by breeding cranes (CWS).

2.4.1.2.1.2 Survey and map movements of family groups on summer range (CWS).

2.4.1.2.1.3 Survey and map movement of failed breeders, subadult birds, and other nonbreeders in vicinity of nesting area, and identify areas used (CWS).

2.4.1.2.1.4 Survey adjacent habitat to locate new breeders (CWS).

2.4.1.2.1.5 Survey use of staging habitat (CWS).

2.4.1.2.2 Determine availability of suitable habitat for breeding, staging, migrating, and other essential uses.

2.4.1.2.2.1 Prepare annual maps to record distribution of nesting pairs, nests, and nonbreeders in WBNP and environs (CWS).

2.4.1.2.2.2 Survey and map potential breeding habitat at WBNP and vicinity using satellite imagery (CPS).
Mapping of crane habitat has been ongoing in WBNP for some time, using satellite imagery and a Geographic Information System (GIS).

2.4.1.2.2.3 Integrate habitat mapping with historical nesting patterns using GIS to evaluate habitat utilization (CPS).

2.4.1.2.2.4 Prepare maps of migration and staging habitat (CWS).

2.4.1.2.3 Determine characteristics of inhabited and unoccupied habitat.

2.4.1.2.3.1 Sample potential food resources of nearby areas where cranes do not occur (CPS).

2.4.1.2.3.2 Sample potential food resources of crane feeding areas within territories (CPS).

2.4.1.2.3.3 Conduct a comparative study on distribution and characteristics of ponds in currently used and potential breeding areas (CPS).

2.4.1.2.4 Determine factors affecting habitat quality.

2.4.1.2.4.1 Assess impact of water level fluctuation on food availability and relate those levels to Whooping Crane reproductive success (CPS).
Whooping Crane reproductive success is low in years of drought, possibly because of lowered food production and availability for growing chicks. The relationship between productivity and water levels needs to be clarified.

2.4.1.2.4.2 Expand existing surface water monitoring network to determine water level fluctuations in crane habitat (CPS).
Such studies would determine seasonal and year-to-year trends in water levels on selected wetland habitat within the general nesting area of the WB–A Whooping Crane population.

2.4.1.2.4.3 Determine the role of fire in creating and maintaining Whooping Crane habitat (CPS).
Fire management is under review in WBNP. Fire suppression will continue in some areas of the park. It is not known if naturally occurring fires would help create and maintain Whooping Crane nesting habitat.

2.4.2. Analyze data to estimate population size, habitat, and recruitment required to achieve goal.

2.4.2.1 Identify key habitat areas required to attain recovery goal.

2.4.2.1.1 Map location of key breeding areas in and near WBNP.

2.4.2.1.1.1 Prepare maps of key existing breeding habitat in and near WBNP (CPS).

2.4.2.1.2 Map location of staging habitat in Saskatchewan.

2.4.2.1.2.1 Prepare maps of key staging habitat in Saskatchewan (CWS).

2.4.2.1.3 Map locations of potential reintroduction sites in Saskatchewan, Manitoba, and western Ontario.

2.4.2.1.3.1 Prepare maps of potential reintroduction sites in Saskatchewan, Manitoba, and western Ontario (CWS).

2.4.2.2 Evaluate ability of existing and potential habitat to support increased population.

2.4.2.2.1 Map locations of potential breeding habitat in and near WBNP, and determine carrying capacity.

2.4.2.2.1.1 Prepare maps of potential breeding habitat in and near WBNP, and assess carrying capacity (CPS).

2.4.2.2.1.2 Compile, analyze, and interpret the results of surface water monitoring (CPS).

2.4.2.2.2 Determine size of area used by individual pairs and progeny to assist in assessing carrying capacity of the habitat.

2.4.2.2.2.1 Prepare maps of territories used by individual pairs of cranes (CWS).

2.4.2.3 Estimate population needed to sustain breeding population at recovery goal level.

2.4.2.3.1 Periodically update the Population Viability Assessment model.

2.4.2.3.1.1 Update the Population Viability Assessment model with incorporation of new methodologies used to estimate minimum viable population size and genetic integrity of the species (CWS).

2.4.2.3.1.2 Develop management options by comparing mean annual growth rates for WBNP population with and without current egg manipulation practices (CWS).

2.4.2.4 Determine long-range consequences of human encroachment.

2.4.2.4.1 Determine impact on current habitat use.

2.4.2.4.1.1 Assess impact of outside threats to habitat use within WBNP (CPS).

2.4.3 Implement required actions to ensure goal is reached.

2.4.3.1 Ecological actions.

2.4.3.1.1 Protect and enhance crane habitat.

2.4.3.1.1.1 Protect breeding grounds from human disturbance.

2.4.3.1.1.1.1 Identify and protect essential breeding habitat and food base (CPS).
CPS will maintain a policy that prevents off-road travel in the area. The breeding area is designated Zone 1, with no motorized access or man-made facilities and no human access from April to September, except park staff and scientists involved in Whooping Crane research.

2.4.3.1.1.1.2 Continue to restrict aircraft flights over the crane breeding area (CPS).
A NOTAM (Notice to Airmen) will be published through Transport Canada to restrict aircraft overflights while cranes are in residence in WBNP. In addition, discussions will be held with local aircraft charter (tour) operators to seek their cooperation in avoiding crane habitat. The Department of National Defence will also be advised of the necessity to avoid the area during overflights or airshows.

2.4.3.1.1.1.3 Implement measures to prevent potentially harmful resource or recreational expansion into the breeding area (CPS).
Developments in or near WBNP must be reviewed carefully and screened under the Environmental Assessment and Review Process (EARP) and mitigation implemented to eliminate disturbance to the nesting cranes and their habitat.

2.4.3.1.1.2 Protect staging habitat from disturbance.

2.4.3.1.1.2.1 Manage potential disturbance to staging cranes by tourists or other visitors (CWS).

2.4.3.1.1.2.2 Consult with landowners to develop a program to ensure security of cranes using migration or staging habitats (CWS).

2.4.3.1.1.2.3 Develop and apply methods to prevent collisions with power lines, communication towers, or other structures (CWS).
Work with power line and utility companies to select routings for new lines or towers and mark existing lines to minimize likelihood of collisions.

2.4.3.1.1.2.4 Identify, evaluate, and reduce other hazards along migration route (CWS).

2.4.3.1.2 Reduce crane mortality on breeding grounds and during migration.

2.4.3.1.2.1 Monitor Whooping Crane health on the breeding grounds and during migration (CWS).
Although no outbreaks of disease in the Whooping Crane flock have been recorded, any sign of disease will be reported and appropriate measures taken to minimize impact.

2.4.3.1.2.2 Determine location of staging areas or migration habitat, and assess risks to cranes using those areas (CWS).
If birds are perceived to be at risk because of hunting activities or presence of disease, follow procedures outlined in the contingency plan (Appendix 2).

2.4.3.1.2.3 Continue to identify, evaluate, and minimize other mortality factors (CWS).
Incidence of predation, or losses from other causes, will continue to be monitored and, if possible, reduced.

2.4.3.1.3 Develop contingency plans for major disruptions.

2.4.3.1.3.1 Maintain and update contingency plan (CWS).
The contingency plan lays out necessary actions in the event of disease outbreaks, pollution, injury, and other threats (Appendix 2).

2.4.3.2 Intensive management techniques.

2.4.3.2.1 Establish and maintain Whooping Crane breeding facilities.
The need for eggs from WBNP is expected to diminish when the captive sites are fully stocked. Subsequent egg pickups may be required to supplement captive production as part of introduction to the wild. Genetic management of captive and new wild flocks may also require small numbers of eggs from new pairs on an irregular basis, for many years. However, it is the intent of the recovery team to reduce and eventually stop the egg removal as soon as practical.

2.4.3.2.1.1 Monitor progress and provide continued support by participation in joint Canada–U.S. Whooping Crane breeding projects.
Effective Whooping Crane breeding programs will eventually result in the establishment of new wild flocks. In keeping with the cooperative nature of the Canada–U.S. MOU, Canada will monitor and continue to provide expertise and support to develop and maintain Whooping Crane populations at Patuxent, Baraboo, and Calgary. Every reasonable effort will be made to ensure the rapid buildup of the reproductive capacity of captive flocks to the level specified in the recovery plan and the Canada–U.S. MOU. WBNP Whooping Crane eggs will be supplied to breeding facilities until population objectives have been met. All captive progeny from WBNP eggs will be permanently marked, and an annual status report on the survival and disposition of progeny will be required from the receiving facility. Recognizing the need to cease the egg collecting in WBNP at the earliest opportunity, the Canada and U.S. Whooping Crane Coordinators, in consultation with other agencies, will determine the need for eggs from WBNP on an annual basis.

2.4.3.2.1.1.1 Contribute eggs from WBNP to existing breeding facilities (CWS).
Eggs have been collected from WBNP from 1967 (Table 1) to support development of Patuxent, Grays Lake, and, more recently, Baraboo flocks. The first priority with regard to egg management is the enhancement of the WB–A flock by ensuring that the maximum number of families hatch a chick. Beyond this, the most important use for surplus eggs will be to continue development of Whooping Crane flocks at Patuxent and Baraboo, where the primary objective is breeding for release into wild flocks. Population objectives for these captive flocks are referenced in the Canada–U.S. MOU (Patuxent, 5–15 breeding pairs; Baraboo, 10 breeding pairs).

All eggs removed from WBNP will be removed under the authority of the three required permits: (a) a Scientific Collecting Permit issued by CWS under the authority of the *Migratory Birds Convention Act*; (b) a Collecting Permit issued by CPS under the authority of the *National Parks Act*, and (c) a Convention on International Trade in Endangered Species (CITES) export permit issued by the CWS CITES Management Authority.

2.4.3.2.1.1.2 Undertake an analysis of eggs that failed to hatch (CWS).
All nonviable eggs will be examined at Calgary Zoo to determine cause of failure. Other institutions that receive viable eggs should continue to make their own arrangements for analyses.

2.4.3.2.1.2 Construct and operate a captive breeding centre in Canada.
The Calgary Zoo has been approved as a Whooping Crane breeding centre, and the first cranes arrived there in November 1992. The first shipment of eggs from WBNP will go to the zoo in 1994. The primary purpose of this facility is to produce young for a Canadian reintroduction effort designed to establish a migrating Whooping Crane flock that summers in Canada and winters in the United States. A population objective for new breeding facilities of 10 breeding pairs is referenced in the Canada–U.S. MOU.

2.4.3.2.1.2.1 Complete construction of a Whooping Crane captive breeding facility at the Calgary Zoo (CZ).

2.4.3.2.1.2.2 Stock the facility with Whooping Cranes and Sandhill Cranes (CZ).

2.4.3.2.1.2.3 Operate the facility to produce Whooping Crane eggs and chicks for release in Canada (CZ).

2.4.3.2.1.2.4 Develop a management plan complete with genetic and demographic objectives for the Canadian captive flock (CZ).
Captive flocks can enhance the genetic diversity of wild populations, accelerate expansion of the population towards the desired level, and provide animals for introduction to new areas (Foose 1992). To optimize these effects, as well as to avoid potential problems in captive flocks (e.g., overcrowding), these flocks will have demographic management objectives as identified in the Canada–U.S. MOU. In addition, genetic goals will be in consort with the species survival plan that will be prepared in the near future.

2.4.3.2.2 Establish additional wild populations.

2.4.3.2.2.1 Establish one independent wild breeding population with a minimum of 25 breeding pairs of Whooping Cranes in Canada, separate from the WBNP population, by 2020.

Canada will begin preliminary efforts aimed at establishing a migratory flock of Whooping Cranes in Canada. There are two major obstacles to be overcome. The first is that no proven release technique has been demonstrated, and the second is that a release site in Canada has not yet been identified. Every precaution will be taken in the establishment of a new wild population to ensure there will be no deleterious effects on the WB–A population. Contact between the two populations will be minimized to prevent transfer of disease and potential disruption of the social system of the flock. The likelihood and severity of such effects will be explored. However, there may be positive genetic benefits from occasional contact between both flocks.

2.4.3.2.2.1.1 Evaluate potential reintroduction sites in suitable habitat in Saskatchewan, Manitoba, or western Ontario (CWS).

Potential reintroduction sites include the Canadian prairies and possibly parts of western Ontario. Areas investigated will be outside of the main migration pathway of the WB–A population.

2.4.3.2.2.1.2 Conduct preliminary field studies to determine migration, staging, and wintering range for resident Sandhill Cranes (CWS).

The study would probably involve satellite radio-tracking of Sandhill Cranes. The study would also involve a public relations effort to ensure that local and flyway concerns are solicited prior to any major work being done.

2.4.3.2.2.1.3 Survey potential breeding areas to determine location, extent, and quality of habitat (CWS).

Habitat requirements have been documented for Whooping Cranes during migration (Armbruster 1990). There has been no detailed study of habitat requirements of Whooping Cranes in WBNP, and little is known about potential breeding habitat suitability at sites other than WBNP. A knowledge of availability of food, including aquatic invertebrates, will help to determine the suitability of the wetland site for use as a breeding area. Variations in water quality have an impact on the availability of food for Whooping Cranes as well as providing information regarding possible pollutants in the wetland system that could have detrimental effects on the birds (e.g., runoff from agricultural fertilizers). Drought conditions pose a problem for breeding Whooping Cranes. This may be even more prevalent in a region that is more arid than WBNP. As well, it is important to avoid a situation such as that which occurred at Grays Lake, where control over the water level in the wetland was not in the hands of the release team or a cooperating agency. Long-term security for the breeding area is essential.

2.4.3.2.2.1.4 Survey staging habitat to determine location, extent, and quality of habitat (CWS).

Armbruster (1990) described the habitat requirements during migration of the WB–A Whooping Cranes. Using this information, the suitability of Sandhill Crane staging areas can be determined. Whooping Cranes following guide Sandhill Cranes would necessarily stage in the same areas as the Sandhill Cranes. It is well documented that the major mortality factor during migration in

the Grays Lake experimental flock was collision with power lines. The potential to mitigate hazards to migration will be determined if fences, power lines, and wires are found in the vicinity of staging areas.

2.4.3.2.2.1.5 Survey wintering areas to determine suitability for development of Whooping Crane pair territories (CWS).
The establishment of a migratory flock of Whooping Cranes breeding in Canada necessarily means that this flock would winter in the United States. The USFWS is the lead agency in Whooping Crane-related research in that country, and those conducting the Canadian flock research would work cooperatively with that agency in surveying the wintering area.

2.4.3.2.2.1.6 Develop a long-term funding source for the project (CWS).
If, based upon the results of the previous investigations, there is potential for a reintroduction effort, acquiring funding for a long-term release program must become a priority. The scope and high profile of the project will provide ample opportunity for involvement of a variety of organizations.

2.4.3.2.2.1.7 Conduct releases, monitor results, and manage released population (CWS).
The next step is to conduct releases at the Canadian candidate area. Work and research plans for this experiment will have to be established at that time. Any new flock must be the subject of an integrated management plan and be screened through the EARP process.

2.4.3.2.2.2 Provide support and assistance with the establishment of wild flocks in the United States (CWS).
CWS will continue to monitor the development of the Florida flock and will provide advice and support as required. A second experimental release technique will be evaluated at Grays Lake and will make use of the returning Whooping Cranes. Male cranes show parental behaviour by setting up territories, attempting to build nests, and helping feed and raise some of the local Sandhill Crane chicks. If these males were separately penned with Whooping Crane chicks raised in captivity using appropriate imprinting techniques, there is a strong possibility that the males would "adopt" the young chicks, and a parent–offspring bond would develop. Female Whooping Cranes could also be captured and penned with young birds in a similar manner. These single-parent families could then be released, and the parent would teach the young foraging behaviour and migration. The young Whooping Cranes would be correctly imprinted, and the female chicks, when of breeding age, would therefore be likely to return to Grays Lake and respond appropriately to the male Whooping Cranes.

2.4.3.2.3 Enhance productivity of the WBNP flock.

2.4.3.2.3.1 Maximize productivity of WBNP flock through testing and substitution of eggs and collection of surplus eggs.
In order to ensure smooth operation of fieldwork during the annual egg pickup, close liaison between CWS and CPS will be maintained at all times.

2.4.3.2.3.1.1 Test viability of eggs at nests and ensure that at least one live egg is left in each nest (CWS).
Testing for viability of eggs younger than 16 days produces uncertain results. If no egg in a nest is viable, a live egg from another nest will be substituted. This manipulation is preeminent over all other programs related to eggs in WBNP, as it has been found to increase the hatching success by 11.7–15.5% during 1985–1988 (Kuyt 1993b). For reasons of logistics and cost, the primary area for retrieval will be the Sass–Klewi region. This area has approximately 30 nesting pairs, which could be expected to yield up to 20 surplus eggs per annum in years of suitable habitat conditions.

2.4.3.2.3.1.2 Collect surplus live eggs and nonviable eggs (CWS).
In conjunction with 2.4.3.2.3.1.1 above, surplus live eggs will be collected for shipment to breeding facilities or reintroduction sites. In addition, nonviable eggs will be collected for analysis to determine cause of infertility or embryonic death. Only eggs that have been incubated in the wild for at least 16 days will be collected as surplus.

2.4.3.3 Sociopolitical actions.

2.4.3.3.1 Develop public support for conservation activities.

2.4.3.3.1.1 Issue press releases on a regular basis to announce significant events (CWS).
Press releases would include December population counts at ANWR and number of surviving young; spring arrival in Saskatchewan and requests for reports of sightings; number of breeding pairs in WBNP; egg pickup and transfer; number of chicks surviving to autumn in and near WBNP; and autumn arrival in Saskatchewan and other provinces and requests for reports on sightings.

2.4.3.3.1.2 Maintain a program to report Whooping Cranes during spring and autumn passage through the Prairie provinces (CWS).
The CWS Whooping Crane Hotline has proved effective and will be maintained. Reports of staging cranes will be verified when possible, and staging habitat will be located and described. Public information kits, which contain an identification guide for Whooping Cranes and look-alike species and further information on migration activities, will be prepared and distributed. The support of nongovernmental organizations and provincial governments will be sought in distributing published material. In cooperation with the provincial governments, a request to hunters to report sightings of Whooping Cranes will be incorporated as part of the synopses of hunting regulations.

2.4.3.3.1.3 Prepare and distribute annual and interim reports of activities carried out under this program (CWS).
All reports will be distributed to the recovery team members and other interested agencies.

2.4.3.3.1.4 Use interpretive programs and media contacts to support Whooping Crane conservation (CWS).
All opportunities to promote Whooping Crane conservation should be taken.

2.4.3.3.2 Develop enforcement programs to protect populations.
The popularity of Sandhill Crane and waterfowl hunting poses the risk of accidental (or deliberate by vandals) shooting of Whooping Cranes. Sport hunting of Sandhill Cranes and, when necessary, that of waterfowl will be

controlled while Whooping Cranes are present or at a perceived risk. This can best be achieved by informal spot closures and by requesting landowners to restrict access while Whooping Cranes are in the area. In addition, increased education efforts, particularly in spring and fall, aimed at hunters and trappers in the WBNP area would help to prevent shooting of Whooping Cranes.

2.4.3.3.2.1 Conduct hunter education programs in the migratory pathway (CWS).

2.4.3.3.2.2 Monitor hunting activity during Whooping Crane migration (CWS).

2.4.3.3.2.3 Investigate suspected cases of loss to shooting, and proceed with charges if warranted (CWS).

Section 3. Implementation schedule

The implementation schedule (Table 2) outlines and prioritizes recovery tasks over the recovery period. It will be used in the ongoing monitoring of all recovery tasks and will provide the basis for funding of recovery actions. Tasks are identified under general categories, and all headings are derived from Section 2, as delineated in the stepdown outline. The schedule ranks objectives and tasks, identifies respective responsible agencies, defines schedules, and estimates costs in terms of financial resources and person-years for the recovery period. Tasks must be continually revised as plans move from implementation to completion as a result of monitoring results and updating information. Each revision will identify additional actions and studies that will be needed during the recovery period.

Recovery priorities are defined as follows:

Priority 1: An action that must be taken to prevent extinction or prevent the species from declining irreversibly in the foreseeable future.

Priority 2: An action that must be taken to prevent a significant decline in species population or habitat quality, or some other significant negative impact short of extinction.

Priority 3: All other actions necessary to provide for full recovery (or reclassification) of the species.

Acronyms used in the implementation schedule are as follows:

CWS - Canadian Wildlife Service
CPS - Canadian Parks Service
A - Alberta
S - Saskatchewan
M - Manitoba
O - Ontario
N - Northwest Territories
USFWS - United States Fish and Wildlife Service
CZ - Calgary Zoo

Table 2. Implementation schedule for Canada's National Whooping Crane Recovery Plan

Action	Recovery Plan No.*	Priority	Responsibility		Target date	Estimated costs (PY/$K)		
			Lead	Coop.		93/94	94/95	95/96
A. Background studies, research, and analyses								
Undertake aerial surveys to locate breeding pairs and determine nesting success	2.4.1.1.1.1	1	CWS	CPS	Annual	0.1/10	0.1/10	0.1/10
At regular intervals, conduct aerial surveys to determine survival and family movement	2.4.1.1.2.1	2	CWS	CPS, USFWS	Annual	0.2/6 0.05/10	0.2/6 0.05/10	0.2/6 0.05/10
Determine causes of egg loss and of chick and adult mortality	2.4.1.1.2.2	2	CWS	CPS	1996	0.05/8	0.05/8	0.05/8
Carry out a study to determine the survival of chicks in relation to food supply and fluctuations in water levels	2.4.1.1.2.3	2	CPS		1996	Incl. in 2.4.1.2.3.1	Incl. in 2.4.1.2.3.1	Incl. in 2.4.1.2.3.1
Collect, collate, and publish information on Whooping Crane sightings, movement, and habitat used during migration	2.4.1.1.3.1	3	CWS		Annual	0.06/1	0.06/1	0.06/1
Determine causes of mortality during migration	2.4.1.1.3.2	1	CWS		Annual	0.01/1	0.01/1	0.01/1
Record association between Whooping Cranes, Sandhill Cranes, Snow Geese, and other waterfowl	2.4.1.1.3.3	3	CWS		Annual	0.01/1	0.01/1	0.01/1
Maintain records of productivity and survival of cranes	2.4.1.1.4.1	2	CWS		Annual	0.01/1	0.01/1	0.01/1
Determine age of first breeding, longevity, and breeding history	2.4.1.1.4.2	2	CWS		Annual	0.05/5	0.05/5	0.05/5
Undertake aerial surveys in WBNP and vicinity to identify areas used by breeding cranes	2.4.1.2.1.1	1	CWS	CPS	Annual	Incl. in 2.4.1.1.1.1	Incl. in 2.4.1.1.1.1	Incl. in 2.4.1.1.1.1
Survey and map movements of family groups on summer range	2.3.1.2.1.2	2	CWS	CPS, USFWS	Annual	Incl. in 2.4.1.1.2.1	Incl. in 2.4.1.1.2.1	Incl. in 2.4.1.1.2.1
Survey and map movements of failed breeders, subadult birds, and other nonbreeders in vicinity of nesting area, and identify areas used	2.4.1.2.1.3	3	CWS	CPS	Annual	0.1/20	0.1/20	0.1/20
Survey adjacent habitat to locate new breeders	2.4.1.2.1.4	2	CWS	CPS	Annual	0.05/5	0.05/5	0.05/5
Survey use of staging habitat	2.4.1.2.1.5	3	CWS		Annual	0.05/2	0.05/2	0.05/2
Prepare annual maps to record distribution of nesting pairs, nests, and nonbreeders in WBNP and environs	2.4.1.2.2.1	2	CWS	CPS	Annual	0.04/2	0.04/2	0.04/2
Survey and map potential breeding habitat at WBNP and vicinity using satellite imagery	2.4.1.2.2.2	3	CPS	CWS	1996	0.08/10	0.08/2	
Integrate habitat mapping with historical nesting patterns using GIS to evaluate habitat utilization	2.4.1.2.2.3	2	CPS		1996	Incl. in 2.4.1.2.2.2	Incl. in 2.4.1.2.2.2	

Table 2. Implementation schedule for Canada's National Whooping Crane Recovery Plan (cont'd)

Action	Recovery Plan No.*	Priority	Responsibility		Target date	Estimated costs (PY/$K)		
			Lead	Coop.		93/94	94/95	95/96
Prepare maps of migration and staging habitat	2.4.1.2.2.4	2	CWS		1996	0.02/0	0.02/0	0.02/0
Sample potential food resources of nearby areas where cranes do not occur	2.4.1.2.3.1	3	CPS		1996	0.15/30	0.15/30	0.15/30
Sample potential food resources of crane feeding areas within territoritories	2.4.1.2.3.2	3	CPS		1996	Incl. in 2.4.1.2.3.1	Incl. in 2.4.1.2.3.1	Incl. in 2.4.1.2.3.1
Conduct a comparative study on distribution and characteristics of ponds in currently used and potential breeding areas	2.4.1.2.3.3	3	CPS	CWS	1996	Incl. in 2.4.1.2.3.1	Incl. in 2.4.1.2.3.1	Incl. in 2.4.1.2.3.1
Assess impact of water level fluctuation on food availability, and relate those levels to Whooping Crane reproductive success	2.4.1.2.4.1	2	CPS		1996	Incl. in 2.4.1.2.3.1	Incl. in 2.4.1.2.3.1	Incl. in 2.4.1.2.3.1
Expand existing surface water monitoring network to determine water level fluctuations in crane habitat	2.4.1.2.4.2	2	CPS	CWS	Annual	0.04/5	0.04/5	0.04/5
Determine the role of fire in creating and maintaining Whooping Crane habitat	2.4.1.2.4.3	3	CPS	NWT	1994	0.02/2		
Prepare maps of key existing breeding habitat in and near WBNP	2.4.2.1.1.1	2	CPS	CWS	1996	0.04/5	0.02/1	
Prepare maps of key staging habitat in Saskatchewan	2.4.2.1.2.1	2	CWS		1998	0.03/1	0.03/1	0.03/1
Prepare maps of potential reintroduction sites in Saskatchewan, Manitoba, and western Ontario	2.4.2.1.3.1	1	CWS	S, M, O	1994	0.15/5	0.15/5	
Prepare maps of potential breeding habitat in and near WBNP, and assess carrying capacity	2.4.2.2.1.1	2	CPS	CWS	1996	0.04/2	0.04/2	
Compile, analyze, and interpret the results of surface water monitoring	2.4.2.2.1.2	2	CPS		1996			0.06/5
Prepare maps of territories used by individual pairs of cranes	2.4.2.2.2.1	2	CWS	CPS	1996	0.04/2	0.04/2	0.04/2
Update the Population Viability Assessment model with incorporation of new methodologies used to estimate minimum viable population size and genetic integrity of the species	2.4.2.3.1.1	2	CWS	USFWS	1996			0.1/5
Develop management options by comparing mean annual growth rates for WBNP population with and without current egg manipulation practices	2.4.2.3.1.2	2	CWS	CPS	1996			0.05/3

Table 2. Implementation schedule for Canada's National Whooping Crane Recovery Plan (cont'd)

Action	Recovery Plan No.*	Priority	Responsibility Lead	Responsibility Coop.	Target date	Estimated costs (PY/$K) 93/94	94/95	95/96
Assess impact of outside threats to habitat use within WBNP	2.4.2.4.1.1	2	CPS		1994	0.01/0	0.01/0	
B. Management and monitoring								
Protect breeding grounds from human disturbance	2.4.3.1.1.1	1	CPS		Annual	0.01/0.5	0.01/0.5	0.01/0.5
Protect staging habitat from disturbance	2.4.3.1.1.2	1	CWS	A, S, M, O	Annual	0.02/5	0.02/5	0.02/5
Monitor Whooping Crane health on the breeding grounds and during migration	2.4.3.1.2.1	2	CWS	CPS	Annual	0.04/2	0.04/2	0.04/2
Determine location of staging areas or migration habitat, and assess risks to cranes using those areas	2.4.3.1.2.2	3	CWS	A, S, M, O	Annual	0.02/5	0.02/5	0.02/5
Continue to identify, evaluate, and minimize other mortality factors	2.4.3.1.2.3	3	CWS	CPS	Annual	0.02/1	0.02/1	0.02/1
Maintain and update contingency plan	2.4.3.1.3.1	2	CWS	All	Annual	0.01/0	0.01/0	0.01/0
Monitor progress and provide continued support by participation in joint Canada-U.S. Whooping Crane breeding projects	2.4.3.2.1.1	1	CWS	CPS, CZ, USFWS	Annual	0.03/1	0.03/1	0.03/1
Construct captive breeding centre in Canada	2.4.3.2.1.2	1	CZ	CWS	1993	0.5/60		
Operate captive breeding centre	2.4.3.2.1.2	1	CZ	CWS	Annual	1.5/85	1.5/95	2.0/115
Establish one independent wild breeding population with a minimum of 25 breeding pairs of Whooping Cranes in Canada, separate from the WBNP population, by 2020	2.4.3.2.2.1	1	CWS	A, S, M, O	2020	0.6/20	0.5/20	0.5/20
Provide support and assistance with the establishment of wild flocks in the United States	2.4.3.2.2.2	1	CWS		2020	0.01/1	0.01/1	0.01/1
Maximize productivity of WBNP flock through testing and substitution of eggs and collection of surplus eggs	2.4.3.2.3.1	1	CWS	CPS	Annual	0.01/6	0.01/6	0.01/6
C. Administration and public relations								
Issue press releases on a regular basis to announce significant events	2.4.3.3.1.1	2	CWS	CPS, CZ, N, A, S, M	Annual	0.01/0	0.01/0	0.01/0
Maintain a program to report Whooping Cranes during spring and autumn passage through the Prairie provinces	2.4.3.3.1.2	1	CWS	A, S, M	Annual	0.01/2	0.01/2	0.01/2
Prepare and distribute annual and interim reports of activities carried out under this program	2.4.3.3.1.3	2	CWS	CPS	Annual	0.08/0	0.08/0	0.08/0

Table 2. Implementation schedule for Canada's National Whooping Crane Recovery Plan (cont'd)

Action	Recovery Plan No.*	Priority	Responsibility		Target date	Estimated costs (PY/$K)		
			Lead	Coop.		93/94	94/95	95/96
Use interpretive programs and media contacts to support Whooping Crane conservation	2.4.3.3.1.4	2	CWS	All	Annual	0.02/0	0.02/0	0.02/0
Conduct hunter education programs in the migratory pathway	2.4.3.3.2.1	2	CWS	CPS, N, A, S, M	Annual	0.01/0	0.01/0	0.01/0
Monitor hunting activity during Whooping Crane migration	2.4.3.3.2.2	2	CWS	CPS, N, A, S, M	Annual	0.02/0	0.02/0	0.02/0
Investigate suspected cases of loss to shooting, and proceed with charges if warranted	2.4.3.3.2.3	1	CWS	CPS, N, A, S, M	Annual	0.01/0	0.01/0	0.01/0

* The Recovery Plan No. corresponds to the section number used to identify an action in the Narrative. (To find the same action in the Stepdown Outline, change the second digit in the Recovery Plan No. to a 3. Thus, Recovery Plan No. 2.4.1.1.1 is found in section 2.3.1.1.1 in the Stepdown Outline.

Section 4. Literature cited

Allen, R.P. 1952. The Whooping Crane. Research Report No. 3, National Audubon Society, New York. 246 pp.

Armbruster, M.J. 1990. Characterization of habitat used by Whooping Cranes during migration. Fish Wildl. Serv. Biol. Rep. 90(4), U.S. Department of the Interior. 16 pp.

Brand, C.J., J. Langenberg, and J.W. Carpenter. 1992. Summary of diseases and disease recommendations in Whooping Cranes. *In* C. Mirande, R. Lacy, and U. Seal (compilers), *Grus americana* Whooping Crane Conservation Viability Assessment Workshop Report, Fossil Rim Wildlife Center, 6–8 August 1991. Captive Breeding Specialist Group (CBSG/SSC/IUCN).

Cooch, F.G. (ed.), W. Dolan, J.P. Goossen, G.L. Holroyd, B.W. Johns, E. Kuyt, and G.H. Townsend. 1988. Canadian Whooping Crane Recovery Plan. Canadian Wildlife Service, Ottawa. 56 pp.

Drewien, R.C. and E.G. Bizeau. 1978. Cross-fostering Whooping Cranes to Sandhill Crane foster parents. Pages 201–222 *in* S.A. Temple (ed.), Endangered birds — Management techniques for preserving threatened species. Univ. of Wisconsin, Madison.

Erickson, R.C. 1975. Captive breeding of Whooping Cranes at the Patuxent Wildlife Research Center. Pages 99–114 *in* R.D. Martin (ed.), Breeding endangered species in captivity. Academic Press, New York.

Foose, T.J. 1992. Interactive management of small wild and captive populations. *In* C. Mirande, R. Lacy, and U. Seal (compilers), *Grus americana* Whooping Crane Conservation Viability Assessment Workshop Report, Fossil Rim Wildlife Center, 6–8 August 1991. Captive Breeding Specialist Group (CBSG/SSC/IUCN).

Kuyt, E. 1981a. Population status, nest site fidelity and breeding habitat of Whooping Cranes. Pages 119-125 *in* J.C. Lewis and H. Masatomi (eds.), Crane research around the world: Proceedings of the International Crane Symposium, Sapporo, Japan.

Kuyt, E. 1981b. Clutch size, hatching success, and survival of Whooping Crane chicks, Wood Buffalo National Park, Canada. Pages 126-129 *in* J.C. Lewis and H. Masatomi (eds.), Crane research around the world: Proceedings of the International Crane Symposium, Sapporo, Japan.

Kuyt, E. 1982. Whooping Crane. Hinterland Who's Who, Canadian Wildlife Service, Ottawa. 6 pp.

Kuyt, E. 1992. Aerial radio-tracking of Whooping Cranes migrating between Wood Buffalo National Park and Aransas National Wildlife Refuge, 1981–1984. Can. Wildl. Serv. Occas. Pap. No. 74. 53 pp.

Kuyt, E. 1993a. Whooping Crane, *Grus americana*, home range and breeding range expansion in Wood Buffalo National Park, 1970–1991. Can. Field-Nat. (in press).

Kuyt, E. 1993b. Case study — Whooping Cranes. *In* A.W. Diamond and B.D. Bell (eds.), The management of populations of endangered bird species. Chap. 4. Reproductive manipulation. International Council for Bird Preservation (in press).

Kuyt, E., B.E. Johnson, and R.C. Drewien. 1981. A wolf kills a juvenile Whooping Crane. Blue Jay 39(2):116-119.

Lewis, J.C., R.C. Drewien, E. Kuyt, and C. Sanchez, Jr. 1992. Contaminants in habitat, tissues, and eggs of whooping cranes. Pages 159–165 *in* Proceedings of the 6th North American Crane Workshop, October 1991, Regina.

Mirande, C., R. Lacy, and U. Seal (compilers). 1992. *Grus americana* Whooping Crane Conservation Viability Assessment Workshop Report, Fossil Rim Wildlife Center, 6–8 August 1991. Captive Breeding Specialist Group (CBSG/SSC/IUCN).

Novakowski, N.S. 1966. Whooping Crane population dynamics on the nesting grounds, Wood Buffalo National Park, Northwest Territories, Canada. Can. Wildl. Serv. Res. Rep. Ser. No. 1. 20 pp.

U.S. Fish and Wildlife Service. 1986. Whooping Crane Recovery Plan. Albuquerque, New Mexico. vi + 283 pp.

Appendix 1.

Memorandum of Understanding Between the United States Fish and Wildlife Service of the United States Department of the Interior and the Canadian Wildlife Service of Environment Canada on the Conservation of the Whooping Crane

The longstanding cooperation of the Canadian Wildlife Service (CWS) and the United States Fish and Wildlife Service (FWS) in recovering the Whooping Crane from the virtual brink of extinction is a model of international cooperation for all nations.

The crane species, along with other shared species, were noted in the United States–Canada Convention for the Protection of Migratory Birds (August 16, 1916) as appropriate subjects for a uniform system of protection and conservation.

To assure that such cooperation is well planned, adequately managed and that the goals and responsibilities of both Parties are clearly understood, the CWS, Environment Canada, and the FWS, Department of the Interior, have entered into this Memorandum of Understanding, hereinafter referred to as the "Memorandum".

I. Purpose

The purpose of this Memorandum is to document arrangements and understandings between the CWS and FWS, hereinafter referred to as the "Parties", which will improve coordination and joint cooperation in Whooping Crane management, research and conservation programs. This cooperation is essential: (1) to improve the habitat and survival rate of these birds in North America; (2) to enhance and maximize program capabilities in both countries; (3) to avoid unplanned duplication of effort; (4) to improve existing practices for the exchanges of information and material (birds and eggs); and (5) to create new flocks and populations.

II. Authority

This Memorandum is hereby entered into by the FWS pursuant to Section 1 of the Fish and Wildlife Coordination Act, 16 U.S.C. 661; Section 7(a)(4) of the Fish and Wildlife Act of 1956, as amended, 16 U.S.C. 742f(a)(4); and Section 8(b) of the Endangered Species Act, 16 U.S.C. 1537(b); and by CWS pursuant to the Migratory Birds Convention Act, R.S. 1985 c. M-7 and the Canada Wildlife Act, R.S. 1985 c. W-9.

III. General Provisions

A. Stewardship of the Parties

All eggs and resulting progeny emanating from either Canadian or United States breeding grounds and captive flocks, including birds held for research or breeding purposes or scheduled for release into the wild, will be under the common stewardship of both Parties.

B. Population Goals — Wild and Captive Flocks

1. The interim goal for the Whooping Crane population now breeding in Wood Buffalo National Park (Park), Northwest Territories, and wintering at and in the vicinity of the Aransas National Wildlife Refuge, Texas, has been jointly established at forty (40) breeding pairs. This goal is subject to upward revision should conditions warrant and both the U.S. and Canadian Whooping Crane Recovery Teams approve. In anticipation of surplus eggs and/or progeny becoming available, the Parties will investigate the possibility of establishing additional wild populations and of extending the breeding range of the Wood Buffalo–Aransas population. Additional wild populations established under this Memorandum will each have an interim population objective of twenty-five (25) breeding pairs.
2. The current goal of the captive breeding program is to develop populations of 5 to 15 pairs, and the associated chicks and subadults at 2 or 3 sites. The purpose of multiple captive flocks is to minimize the chance of disease or natural catastrophes decimating all the

captive birds and to increase the avicultural talents available for the recovery of the Whooping Crane.

C. Captive Flocks

The population goal of the captive flock at Patuxent Wildlife Research Center (Patuxent) is 5 to 15 pairs. The Patuxent flock will provide birds for captive propagation research and wild release research while simultaneously producing birds to build the captive flock for wild release. Approval is given to establish at least one additional captive flock in the United States at the International Crane Foundation (ICF), Baraboo, Wisconsin, and one in Canada, each containing up to 10 breeding pairs. The primary purpose of the two new captive flocks will be production of birds for wild release. If the Canadian site is established, subadults for this flock will be provided from those at Patuxent and the ICF at a combined rate of four to six birds annually for 4 years. At each captive flock site, avicultural practices and facilities will conform to the intent of the appropriate national animal welfare legislation and policies.

Building the captive flocks is a recovery priority of the Parties for the early 1990s. A large captive flock, in the aggregate, is viewed as essential for supplying the numbers of released birds (up to 20 annually) required to assure the success of future restoration efforts. A primary reason for having two or three captive breeding sites is for protection and management of the genetic composition represented in the captive population.

All reasonable efforts will be made to optimize genetic diversity of each captive flock. The Whooping Crane Coordinators (Coordinators) of the Parties (see Section IV) will oversee all captive flocks to ensure that birds are being cared for in a manner appropriate to accomplish established recovery goals.

D. New Wild Populations

1. Every reasonable effort will be made to create new wild populations, using eggs or birds which are surplus to existing programs. Sites for establishing new populations will be selected with the intention of creating both resident and migratory populations. Criteria will be developed governing the release of birds or eggs at new sites and will include, among others, consideration of impacts on resident populations of Sandhill Cranes, possible conflict with established hunting practices in areas likely to be used by Whooping Cranes, and measures to insure releases do not pose any risk to the existing wild flock. Both Parties will approve the sites before birds or eggs are placed there.
2. It is the intent of the Parties that all efforts to establish new populations be implemented cooperatively. Efforts to establish a migratory or a non-migratory flock need not be mutually exclusive and could proceed simultaneously if sufficient eggs or birds were available.

E. Disposition of Specimens, Parts and Handicapped Birds

1. The carcasses of dead birds (captive-reared or recovered from the wild), parts thereof, nonviable eggs, and fragments of hatched eggs have scientific value. These specimens will be distributed for scientific and educational use following consultation between the Coordinators. The Coordinators will develop and adopt standardized procedures of postmortem analysis of eggs and birds which die within their respective jurisdictions, and will share such specimens and analyses as equally as possible. Each coordinator will endeavor to ensure the timely transfer of material, whether living or dead, to the other. In Canada, the repository for specimen material is the National Museum of Natural Sciences in Ottawa. In the United States, the main repository for specimen material is the National Museum of Natural History in Washington, D.C.
2. Sick or injured birds recovered from the wild and nursed back to health will be evaluated for placement in an

appropriate breeding facility or for return to the wild. The Coordinators will jointly make this evaluation. If the bird is not suitable for release in the wild, Coordinators will decide which captive site should house the bird.

F. Disposition of Excess Viable Wild Eggs, Wild Birds, and Captive-Produced Birds and Eggs

Excess viable wild eggs are those eggs at the Park or elsewhere that are available after one or two viable eggs are left in each nest. Excess wild birds are those which become either non-essential to the population of their origin or for genetic or other reasons have greater recovery value at another site. The Coordinators, after consultation with other affected individuals, and agencies will jointly decide the uses of these eggs, wild birds, and captive-produced birds which will most benefit recovery, including building captive flocks, building existing wild flocks, maintaining captive flock genetic diversity, or introducing birds to a new location.

G. Contingency Plans

The Parties will maintain operational Contingency Plans in place which prescribe the procedures to follow if it becomes necessary to retrieve or remove Whooping Cranes from any place as a result of hunting, environmental hazard, or injury.

H. Habitat Rehabilitation and Preservation

The Parties agree to undertake all reasonable efforts to protect from encroachment or degradation the habitats used by the existing wild flock or any new flock(s).

I. Recovery Plans

The Parties will update and share their existing national recovery or action plans in accordance with their respective needs. These national plans will reflect the terms and intent of the Memorandum.

IV. Consultation and Coordination

The Parties agree to maintain close consultation. Each Party will appoint a Whooping Crane Coordinator and an alternate to coordinate the day-to-day implementation of this Memorandum. The CWS Coordinator will be an ex officio member of the Whooping Crane Recovery Team in the United States. The FWS Coordinator will be an ex officio member of the Whooping Crane Recovery Team in Canada. The Coordinators will make every effort to:

a. Ensure that both countries are informed on any environmental problems or activities that could adversely affect the welfare of the Whooping Crane.
b. Arrange for disposition of specimens, parts, birds and eggs, as per Section III C, D, E, and F of this Memorandum.
c. Evaluate rescued wild birds that have recuperated and make appropriate recommendations for their disposition (Section III E).
d. Monitor captive propagation and provide guidance and program direction which will help these facilities attain recovery objectives (Section III C).
e. Coordinate research and management activities between the Parties, including the regular exchange of progress reports, final reports, and pertinent data and the development of research and management programs.

V. Criteria and Procedures

A. Criteria and procedures developed in support of this Memorandum will be considered as incorporated by reference following signature by the officers of the FWS and CWS designated in the Memorandum. The existing joint FWS/CWS Program Review Committee will review and, as deemed appropriate, recommend changes in this Memorandum or criteria and procedures developed in support of this Memorandum.

B. It is understood that the program of cooperation set forth in this Memorandum will be contingent upon the availability of funds to each Party.

VI. Participants

In addition to CWS and FWS, other agencies and organizations may be specifically included as participants as appropriate and as mutually agreed upon in writing.

VII. Effective Date

This Memorandum will come into effect on the date of signature and will remain in force for five (5) years unless terminated earlier by either Party upon ninety (90) days written notice to the other. The Memorandum may be renewed for additional five (5) year terms and may be amended at any time by mutual agreement of the Parties. It is the intent of the Parties that this Memorandum supersedes all previous arrangements and understandings made with regard to the conservation and protection of the Whooping Crane.

Signed at *Denver, Colorado* this *19th of April 1990*

FOR:

The Department of the Interior, The United States Fish and Wildlife Service

_____

Director

Environment Canada, Canadian Wildlife Service

_____

Director-General

Appendix 2.

Canadian Whooping Crane Contingency Plan

Preamble

As of November 1992, the Wood Buffalo–Aransas flock of Whooping Cranes had increased to 140 birds. While the numbers are increasing, the loss of even a single bird is still significant and a matter of public and professional concern. The CWS and cooperating agencies must be prepared to address any emergency in a rapid and coordinated manner.

Objectives

1. To put in place plans to meet emergency situations wherein Whooping Cranes are perceived to be at risk; to designate appropriate response options (Figure A1) and reporting procedures whenever Whooping Cranes are reported as sick, injured, or dead, or if they are in locations where they face hazards such as contaminants, disease, power lines or where hunting of species that resemble immature or adult Whooping Cranes (such as Snow Geese or Sandhill Cranes) is occurring.
2. To reduce Whooping Crane use of sites deemed to represent a disease, pollutant, or structural hazard.
3. To provide protection for Whooping Cranes where hunting is in progress.
4. To optimize the opportunity to recover and rehabilitate wild Whooping Cranes found injured or sick, and to assist in identifying and removing causes of mortality or injury.
5. To optimize the opportunity to recover dead Whooping Cranes for preservation as scientific specimens and for necropsy to determine cause of death.
6. To identify areas used by Whooping Cranes and use such information to guide landowners in carrying out practices that are not potentially damaging to Whooping Cranes.

Administration

To facilitate prompt response to situations involving Whooping Cranes, the following procedures will be implemented.

1. Responsibility Centres will be established at Edmonton, Alberta; Saskatoon and Regina, Saskatchewan; Winnipeg, Manitoba; and Fort Smith, N.W.T.

1.1 CWS Edmonton, (403) 468-8928, R. Edwards will have primary responsibility for Alberta and the N.W.T.

1.1.1 CPS Fort Smith - J. Morgan (403) 872-2349; GNWT Wildlife Management Division, Yellowknife - R. Bromley (403) 920-6328; and CWS Ft. Smith - B. Johns (403) 872-2101 will serve as Responsibility Centres for situations involving Whooping Cranes in or near Wood Buffalo National Park.

1.1.2 CWS Edmonton and the Alberta Fish and Wildlife Division will be responsible for situations within the province of Alberta falling outside Wood Buffalo National Park.

1.1.2.1 The Director, Fish and Wildlife Division, Department of Environmental Protection, Government of Alberta, (403) 427-4192, will serve as the alternate Responsibility Centre for Alberta.

1.2 CWS Saskatoon (B. Johns), (306) 975-5595, will have responsibility for situations arising in Saskatchewan. The phone at Saskatoon is on 24 hour call, 7 days per week during periods of migration and staging.

1.2.1 The Director, Wildlife Branch, Government of Saskatchewan, (306) 787-2309, will serve as the alternate Responsibility Centre for Saskatchewan.

1.3 CWS Winnipeg, (204) 983-5260, will have responsibility for situations arising in Manitoba.

1.3.1 The Director, Wildlife Branch, Government of Manitoba, (204) 786-9483, will serve as the alternate Responsibility Centre for Manitoba.

1.4 Alternate Responsibility Centres will be kept up to date on current sightings and any relevant situations which might arise.

1.5 If the birds are perceived to be at risk the Responsibility Centres will immediately inform:

1.5.1 Regional Director, Western and Northern Region, Canadian Wildlife Service, (403) 468-8903, and/or the Biologist-in-Charge of the Whooping Crane Program, B. Johns (306) 975-4109 (Office) and (306) 373-1228 (Home).

1.5.2 National Coordinator, R. Edwards (403) 468-8928 (Office), (403) 459-2215 (Home), who will inform the U.S. Coordinator, Dr. James C. Lewis (505) 766-3972 (Office), (505) 821-3823 (Home).

1.5.3 Appropriate CWS, Provincial, GNWT and/or CPS staff.

1.6 Upon receipt of the report and having alerted others identified under 1.3, CWS/Provincial/NWT/CPS Responsibility Centre will implement the appropriate Contingency procedure as outlined in 2. et seq.

2. The Primary Responsibility Centres, in conjunction with CPS, Provincial and NWT Responsibility Centres, will make an assessment of the type of risk to Whooping Cranes.

2.1 In the event that Whooping Cranes are present during a hunting season they will determine if action to close the season is required under Sections 18 or 37 of the Migratory Birds Regulations.

2.1.1 If the birds are free-flying and healthy, immediately contact local radio and TV stations informing them of the presence of Whooping Cranes and warning hunters to take extreme caution when hunting.

2.1.2 Alert nearest CWS, RCMP and Conservation Office of the location of the crane(s), requesting them to investigate promptly and report back about bird(s) activities.

2.1.3 Contact landowner and neighbours requesting that permission to hunt be deferred until after the departure of the crane(s).

2.1.4 Meet with landowner to determine if normal farming practices can be suspended or modified until cranes have left.

2.1.5 If crane(s) are in heavily hunted areas, close season as provided in Sections 18 and 37 of the Migratory Bird Regulations.

2.2 In the event that a Whooping Crane is reported to be sick or injured, immediate implementation of the approved rescue procedure is required.

2.2.1 Advise veterinary Responsibility Centre.

2.2.1.1 In Saskatchewan the Veterinary Contact is Dr. Gary Wobeser, Saskatoon, Saskatchewan. His office number is (306) 966-7310 and residence (306) 374-5605.

2.2.1.2 In Alberta, the Veterinary Contacts are Dr. James Hanson,

Edmonton, office number (403) 436-8643 and residence (403) 922-2824; and Dr. Bob Cooper, Calgary Zoo, (403) 232-9300.

2.2.1.3 If additional veterinary assistance or advice is needed contact either Dr. Milton Friend, National Wildlife Health Laboratory, Madison, Wisconsin, (608) 271-4640 or Dr. George Gee or Dr. Glen Olsen, Patuxent Wildlife Research Center, Laurel, Maryland, (301) 498-6324.

2.2.2 CWS Regional Responsibility officers will immediately proceed to the area and retrieve the sick or injured crane.

2.2.3 In anticipation of an event under 2.2, the primary Responsibility Centres will have on standby all materials required to capture, immobilize and transport the sick or injured crane to the designated veterinary centre.

2.2.3.1 Loose burlap or vet wrap and tape for immobilizing birds' wings.

2.2.3.2 Crate for transport.

2.2.3.2.1 Acceptable dimensions are 50 cm wide, 65 cm long and 105 cm high.

2.2.3.2.2 Outdoor carpeting to be placed on bottom of crate to prevent bird from slipping.

2.2.3.2.3 Ensure adequate ventilation by drilling 5 rows of 1.5 cm holes, 5 per row on each side of box.

3. Recommended procedures to be followed when capturing, immobilizing, transporting or housing a sick or injured Whooping Crane include:

3.1 Do not alert the media or public action groups until the crane has been successfully captured and removed, in order to avoid undue alarm to the bird during capture which might result from crowds of people.

3.2 The designated veterinarian should be present if at all possible or provide advice in advance, since general practitioners may lack experience in handling sick or injured wild birds. In the event that the designated veterinarian is not available, use nearest veterinary assistance.

3.3 Once the bird has been crated, every effort should be made to keep bird standing, since once it sits down, prognosis for eventual recovery lessens.

3.4 If bird can make short escape flights and if capture and removal are deemed to be desirable, the bird should be kept under scrutiny during daylight hours and captured by lights during dark nights.

3.5 Personnel involved in any capture attempts of adult birds should wear protective eye shields because of danger from the bill or feet of a frightened bird.

3.6 Ensure that the bird's wings are immobilized during transportation but not bound so tightly as to impair circulation or breathing.

3.7 Ensure that housing area is free of all foreign objects which might be ingested by cranes (especially plastic and metal).

3.8 Ensure that housing area is kept dimly lit or dark.

3.9 Ensure that area has not previously been used for domestic birds since cranes are susceptible to diseases.

4. Recommended procedures to be followed when retrieving a dead bird.

4.1 No commitments as to future disposition of the specimen are to be made since the Canada–US MOU clearly states that all specimen material is to be shared between the two countries. In Canada the final repository is the Canadian Museum of Nature.

4.2 The specimen should be kept cool, not frozen, and transported immediately to Dr. Gary Wobeser, Dr. James Hanson or Dr. Bob Cooper for necropsy.

4.3 Care is to be taken during necropsy to save as much of the internal parts of the specimen as possible in addition to the skin.

4.4 Upon completion of the necropsy, the entire carcass is to be frozen and sent to Mr. Michel Gosselin, Collection Assistant (Birds), Canadian Museum of Nature, P.O. Box 3443, Station D, Ottawa, Ont. K1P 6P4.

4.5 Copies of the necropsy report are to be forwarded to the National Coordinator, the Regional Director, CWS, the National Coordinator, USFWS, and the jurisdiction from which the deceased bird was removed.

4.6 Even if toxic chemicals are not suspected as contributing to the death of the bird, appropriate aliquots are to be sent to the Wildlife Toxicology and Pathology Division, CWS National Wildlife Research Centre, 100 Gamelin Boulevard, Hull, (819) 997-1410, as per their instructions.

4.7 All efforts will be made to develop a coordinated United States–Canada necropsy report and examination protocol as provided by the Canada–US MOU.

Decision Key

Response options when a Whooping Crane report is received

CPS, Provincial, NWT or CWS Personnel receive report. Report relayed to the Provincial, NWT, CPS, or CWS employee designated as the Responsibility Centre within that area's boundaries. Responsibility Personnel receive report. Each keeps the other informed. Report response options are:

a. No further action required
Observation likely invalid due to description of the bird, bird's behaviour or report appears unverifiable (e.g. bird flying when sighted).

a. Further action appropriate
If sighting probable or confirmed and bird(s) is on the ground. If probable, it should be checked to ascertain if bird(s) is healthy or if a hazard exists.

b. Searchers are unable to confirm report.
After reasonable efforts are made, no further action required.

b. Sighting confirmed, no unusual hazard present, bird(s) healthy
If practical, bird should be checked daily or less frequently until departure.

b. Confirmed as sick, dead, or injured, or hazard exists

c. Bird(s) is sick, dead, or injured
Whooping Crane Coordinator, Regional and Provincial Directors are informed. CWS employees then follow procedures outlined in this plan. Provincial, CPS or RCMP personnel participate as required.

c. Bird(s) is healthy but hazard exists
In some disease and contaminant hazard situations, field personnel will need to act promptly and chase the cranes from the site. In all other circumstances, the Provincial Wildlife Director and the

Regional Director CWS jointly decide on an appropriate response.

d. Contaminant
CWS regional pesticide specialist, D. Forsyth, Saskatoon (306) 975-5065 is notified.

- Lure or haze birds away from site.
- Divert, confine or remove contaminant.

d. Disease
Responses will vary with the type of disease involved.

- Lure or haze birds away from disease site.
- Diminish or eliminate disease organism.
- Other responses depending on circumstances.

d. Hunting hazard
Hunting hazard exists because hunting is underway or soon will begin for Whooping Crane look-alike species. Options are:

- Informal spot closure. Take whatever action is needed to protect Whooping Cranes. This may include media involvement via newspaper, radio and TV announcements; contact of hunting clubs and individual hunters in the vicinity; acquiring cooperation of landowners; restricting public access to the site; and daily monitoring of the crane(s).
- Formal Spot Closure — Post the small area used by Whooping Cranes with *no hunting* signs under Section 18 of Migratory Birds Regulations.
- Formal closure of season when spot closure cannot be accomplished.
- Encourage Whooping Crane(s) to move. Use this option only in unusual circumstances.

Previous Publications

Canadian Whooping Crane Recovery Plan	December 1987
Anatum *Peregrine Falcon Recovery Plan*	October 1988
RENEW Report No. 3 *National Recovery Plan for the Baird's Sparrow*	April 1993
RENEW Report No. 4 *National Recovery Plan for the Roseate Tern*	June 1993
RENEW Report No. 5 *National Recovery Plan for the Greater Prairie-Chicken*	October 1993

Recovery of Nationally Endangered Wildlife

In 1988, the Wildlife Ministers' Council of Canada endorsed a new strategy to rescue wildlife species at risk of extinction and to prevent other species from becoming at risk. Called RENEW (the acronym for Recovery of Nationally Endangered Wildlife), the strategy brings together all agencies, organizations, and interested individuals to work as a team for the recovery of wildlife at risk. RENEW focuses on those species or populations of terrestrial mammals, birds, reptiles, and amphibians that have been designated as extirpated, endangered, or threatened by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC). The RENEW strategy is implemented by a committee of the same name composed of the directors of provincial, territorial, and federal government wildlife agencies plus the heads of the three major national wildlife organizations (Canadian Nature Federation, Canadian Wildlife Federation, and World Wildlife Fund [Canada]). The RENEW committee establishes a "recovery team" of experts for each species to produce a recovery plan which then becomes the basis for a recovery program carried out by the responsible governments in cooperation with universities, businesses, and private citizens.

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